FISHERIES GAME & FOREST COMMISSION

Third Annual Report

of the

Commissioners of Fisheries, Game and Forests

of the

State of New York.

WYNKOOP HALLENBECK CRAWFORD CO.,
PRINTERS,
NEW YORK AND ALBANY.
1898.

WHERE THE GAFFER COMES IN.

Third Annual Report

of the

Commissioners of Fisheries, Game and Forests.

Albany, N. Y., January, 20, 1898.

Hon. James M. E. O'Grady,

Speaker of the Assembly, Albany, N. Y.:

Sir:—We have the honor to submit herewith, as required by law, the official Report of this Board for the year ending September 30, 1897.

We are, Sir,

Very truly yours,

Barnet H. Davis,
President.

William R. Weed,

Chas. H. Babcock,

Edward Thompson,

Hendrick S. Holden,

Commissioners of Fisheries, Game and Forests.

State of New York.

Commissioners of Fisheries, Game and Forests.

Barnet H. Davis, President,	Palmyra, N. Y.
Hendrick S. Holden, Commissioner,	Syracuse, N. Y.
William R. Weed, "	Potsdam, N. Y.
Charles H. Babcock, "	Rochester, N. Y.
Edward Thompson, "	Northport, L. I., N. Y.
Charles A. Taylor, Assistant Secretary,	Albany, N. Y.

Standing Committees.

Executive,	Messrs. Holden, Babcock, Davis.
Forest Preserve and State Lands,	Messrs. Weed, Holden, Davis.
Hatcheries, Fish Culture and Game,	Messrs. Babcock, Thompson, Davis.
Shellfish, Licenses and Permits,	Messrs. Thompson, Holden, Davis.
Legislation,	Messrs. Davis, Weed, Babcock.

State Fish Culturist.

A. Nelson Cheney, ... Glens Falls, N. Y.

Superintendent of Hatcheries.

James Annin, Jr., ... Caledonia, N. Y.

Superintendent of Forests.

William F. Fox, ... Albany, N. Y.

Chief Game Protector and Forester.

J. W. Pond,	Albany, N. Y.
William Wolf, Clerk,	Albany, N. Y.

Assistant Chief Game Protectors and Foresters.

John E. Leavitt,	Johnstown, N. Y.
Mannister C. Worts,	Oswego, N. Y.

A. J. Mulligan, Audit and Pay Clerk,	Albany, N. Y.
A. B. Strough, Special Agent,	Albany, N. Y.
M. C. Finley, Special Agent,	Palmyra, N. Y.
J. J. Fouqurean, Stenographer,	Albany, N. Y.

Table of Contents.

CISCO FROM HEMLOCK LAKE.

(ARGYROSOMUS ARTEDI, Le Sueur.)

List of Illustrations.

THE PRINTING OF THIS ENTIRE BOOK, INCLUDING THE COLORED AND ARTOTYPE ILLUSTRATIONS, HALF-TONES AND TEXT, WAS EXECUTED BY

WYNKOOP HALLENBECK CRAWFORD CO.,

ART PRINTING WORKS,

NEW YORK AND ALBANY.

PREFACE.

"SWEETS TO THE SWEET."

THE Third Annual Report of the Fisheries, Game and Forest Commission is of the same general character as the two reports which have preceded it, and doubtless there will be the same demand for it as was created by the appearance of the reports for the years 1895 and 1896.

The number of copies of each report is limited by law, and annually the applicants exceed by several thousand the number of copies provided for distribution. So far as it is possible to do so, copies of the report are placed with public libraries, commissions, schools, etc., that it may be more accessible to the general public than when it is distributed to individual applicants only. Apparently no public document has ever met with greater favor from the people than the annual reports of this Commission; and, in consequence of the very complimentary notices it has received from the press at home and abroad, requests for the volume have been sent to us from nearly every civilized country on the globe, in addition to the great number which have come from our own people and the people of every State in the Union. Flattering as this is to the Commission, it is with regret that many applicants have been denied in the past, as undoubtedly they will have to be denied in the future, because of the limit to the annual edition. It is the aim of the Commissioners to make these reports not only accurate statistically, but educational as well,

and therefore the correct figures of birds and fishes in colors have been continued, and special articles have been written concerning some of them by those who are acknowledged authorities in their particular field. The work of the Commission is largely devoted to the propagation of what are commonly called commercial fishes, although all fish cultivated are food fishes. But, there is no special appropriation made by the State to gather statistics relating to the commercial fisheries, nor is such an appropriation necessary, for the Federal Commission has a staff of field agents carefully gathering such statistics in all the States, and they are always available through the courtesy of the United States Fish Commission. In previous reports we have given the figures of the shad catch in the Hudson as collected by our own agents, and the statistics of the commercial fisheries in interior State waters, and now present Mr. John N. Cobb's paper in regard to so much of the Lake Ontario fisheries as relate to countries bordering on the lake. While the report and appendices have been in press, section 249 of the Fisheries, Game and Forest Law has been repealed, as we urged most vigorously in our preliminary report to the Legislature.

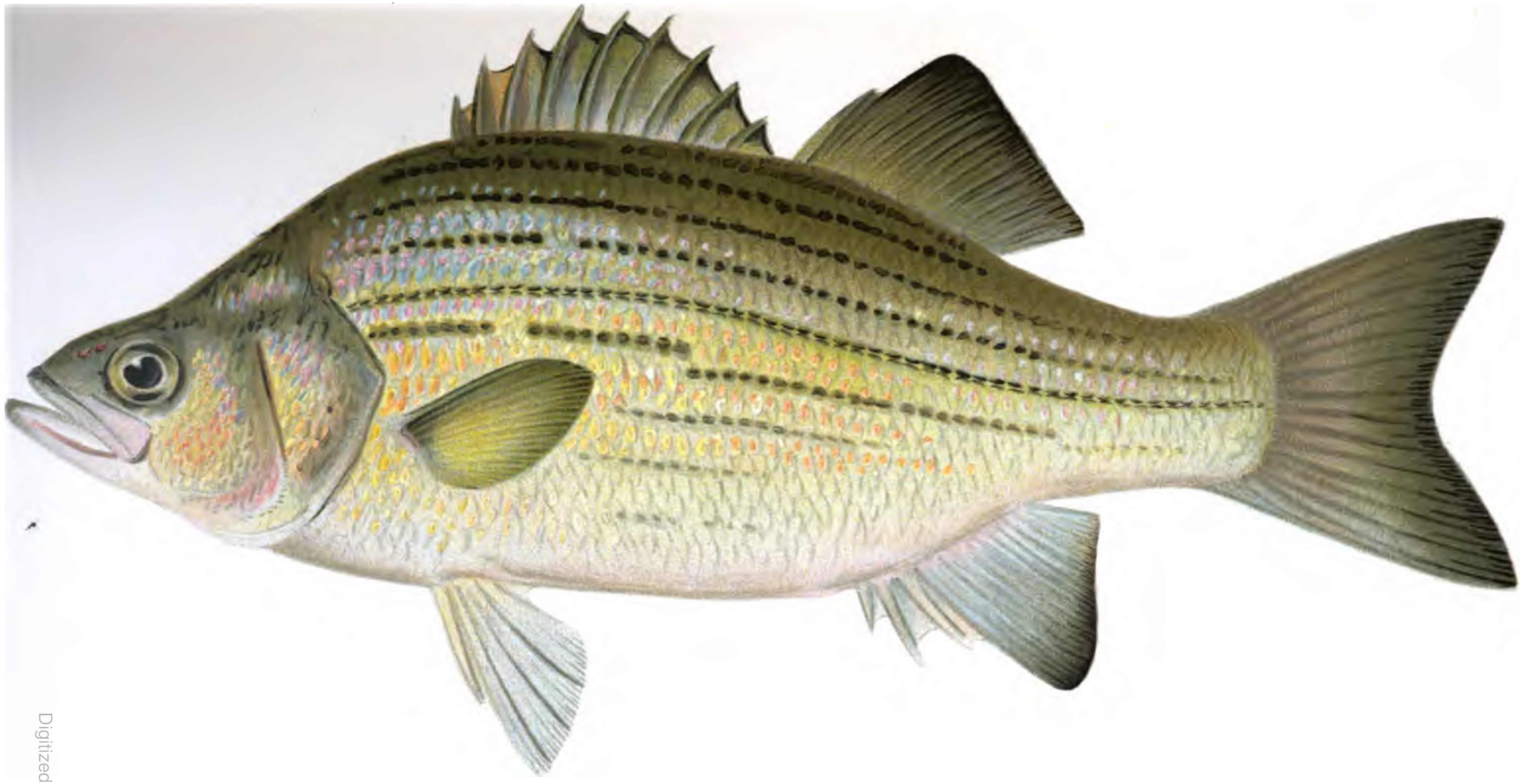
Especial pains have been taken in this report, as in previous ones, to publish correct statistics as to the annual product of the Adirondack forests, such information being necessary in determining the forest policy of the State. In connection with this matter the Commission desires to acknowledge the courteous co-operation of the various business firms and individuals engaged in the manufacture of lumber and woodpulp, who, without an exception, furnished from their books the figures for the amount of timber consumed during the past year. The important relation of these statistics to forestry matters in our State must be apparent to every reader. Great care was also taken in securing a detailed report of each forest fire. The firewardens evinced a commendable readiness in forwarding their statements; but there seemed to be a general tendency on their part to exaggerate both the acreage and the damage, an excusable error due to a zealous interest in their work rather than carelessness.

The Commission desires to acknowledge with thanks the valuable and interesting contribution from Mr. George W. Rafter, C. E., a recognized authority on the subject of forest reservoirs and their relation to our industrial interests.

A valuable and timely article on the protection of shade trees from destructive insects was prepared for this report by Professor Ephraim P. Felt, the State Entomologist; but it is held over for publication in our next report in order to better prepare the illustrations which are to accompany it.

Our thanks are due to the Century Publishing Company for cut of snipe family, by Beard, and we desire to acknowledge the courtesy of the United States Fish Commission and of the railroads of the State for continued favors.

THE COMMISSIONERS.



WHITE BASS.

[ROCCUS CHRYSOPS. Rafinesque.]

REPORT

of the

Commissioners of Fisheries, Game and Forests.

To the Honorable, the Legislature of the State of New York:

THE RIGHT KIND OF A COOK.

IN accordance with section 8 of chapter 395 of the Laws of 1895, we have the honor to submit herewith a report of the official operations of this department for the fiscal year ended September 30, 1897. The following rules and regulations, which were adopted by the Commission May 29, 1895, have been observed in the transaction of the business of the department during the year:

1. Regular meetings of the Board shall be held on the second Tuesday of January, April, July and October, at the office of the Commission, in Albany, and at such other times and places as the same may be called.

2. Special meetings of the Board may be called at any time by the President, or, in case of his disability, by the Executive Committee, or upon the written request of any three Commissioners. Written notice of all special meetings must be given at least twenty-four hours previous thereto.

3. A majority of the Board shall constitute a quorum for the transaction of business, and all questions shall be determined by a majority of those present, a quorum voting.

4. The presiding officer and all other members present shall vote upon all questions unless excused by the Board.

5. The presiding officer shall determine all questions of order; and, in case of an appeal, a majority present may overrule his decision.

6. The President shall preside at all meetings when present. In the absence of the President, the Board shall elect one of their number to preside.

7. The order of business of the Board shall be:

(1) Roll-call.
(2) Reading and correction of minutes of last meeting.
(3) Report of Shellfish Commissioner.
(4) Report of State Fish Culturist.
(5) Report of Engineer (Superintendent of Forests).
(6) Report of Chief Protector.
(7) Secretary's report.
(8) Report of Auditing and Pay Clerk.
(9) Reports of Standing Committees.
(10) Reports of Special Committees.
(11) Miscellaneous and unfinished business.

8. The following standing committees of three each, of which the President shall be one, shall be appointed by the President:

Committee on Forest Preserve and State Lands.
Committee on Hatcheries, Fish Culture and Game.
Committee on Licenses, Permits and Shellfishery.
Executive Committee.
Committee on Legislation.

9. It shall be the duty of the Committee on Forest Preserve and State Lands to consider and report upon all matters of land purchases and business incidental thereto, including the examination of offers which may be submitted, questions of land value, the extent and nature of timber-thieving and measures which should be adopted to suppress it; also to consider and suggest plans for the better organization of the Firewarden system, and other matter arising out of the business connected with the forest and State lands in the care and custody of the Commission.

10. It shall be the duty of the Committee on Hatcheries, Fish Culture and Game to have charge of all matters pertaining to the hatching, culture and distribution of fish; repairs and improvements to hatcheries; also, to look after the business and interests of the Commission in reference to the protection and preservation of fish and game.

11. The Committee on Licenses, Permits and Shellfish shall formulate and submit the rules for licensing net-fishing, as provided by law, and also for granting permits; and shall from time to time examine all licenses and permits granted, and ascertain whether the terms and conditions of the same have been abused or violated. They shall also have general charge of matters pertaining to the shellfish department not specially delegated to the Shellfish Commissioner by law.

12. The Executive Committee shall examine and audit all accounts, bills and payrolls and endorse the same with their approval, when passed; and no bills or accounts shall be paid until so approved; examine and check all books and accounts; examine and check all regular and special reports of employes as often as once in each month and report the result of such examination to the Commission at its first meeting thereafter. They shall also have a general supervision of the business of the Commission and care and control of its interests when the Board is not in session.

13. The Committee on Legislation shall look after the necessary legislation of the Commission; shall examine and consider all proposed amendments or changes in the fish, game and forestry laws or new laws affecting these interests, and shall submit to this Board their opinion upon matters which, in their judgment, require legislative action.

14. The foregoing rules may be altered or amended by vote of a majority of the Commission, upon ten days' notice being given, which notice may be in open meeting and entered on the minutes or by serving written notice.

Commissioner Lyman, having been appointed by the Governor to the office of State Commissioner of Excise, was succeeded on this Commission by Hendrick S. Holden, of Syracuse, April 8, 1896. Mr. Holden was appointed to fill the vacancies in the several standing committees caused by the retirement of Mr. Lyman.

Standing Committees.

Forest Preserve and State Lands.—William R. Weed, Hendrick S. Holden, Barnet H. Davis.

Executive.—Hendrick S. Holden, Charles H. Babcock, Barnet H. Davis.

Hatcheries, Fish Culture and Game.—Charles H. Babcock, Edward Thompson, Barnet H. Davis.

Legislation.—Barnet H. Davis, William R. Weed, Charles H. Babcock.

Chapter 169, Laws of 1896, passed March 31, 1896, to amend chapter 395 of the Laws of 1895, under which this Commission was appointed, provided, among other things, for the compensation and expense of the Commissioners; for the designation of one of the Board to act as Secretary thereof; for the lease of an office in the city

of New York or Brooklyn for the transaction of business connected with the leasing of lands under water, as provided by law; and for the appointment of an assistant secretary.

Under the act referred to, an office was opened May 1, 1896, at No. 1 Madison avenue, New York City, for the shellfish department of the State, and Charles A. Taylor was appointed assistant secretary of the Commission.

The following is a summary of the financial transactions of the Commission for the fiscal year:

Financial Statement

For the Fiscal Year Ending September 30, 1897.

GENERAL MAINTENANCE ACCOUNT.

RECEIPTS.

Balance October 1, 1896,	$25,377 70	
Appropriation, Chap. 948, Laws of 1896:		
For maintenance of hatcheries and hatching stations, collection and distribution of fish and fish fry,	54,000 00	
Salaries and expenses of Fish and Game Protectors and Forresters,	35,650 00	
Salaries and expenses of Commissioners and Officials,	24,000 00	
Clerical Force,	6,000 00	
Maintenance of Shellfish Department,	6,750 00	
Stationery, printing and office expenses,	3,750 00	
		$155,527 70

DISBURSEMENTS.

For maintenance of hatcheries and hatching stations, and collection and distribution of fish and fish fry,	Schedule "A,"	$53,394 64	
Fish and Game Protectors and Forresters,	" "B,"	41,905 32	
Official salaries and expenses,	" "C,"	23,698 08	
Clerical Force,	" "D,"	6,083 34	
Shellfish Department,	" "E,"	3,625 69	
Office Expenses,	" "F,"	4,012 93	
			$132,720 00
Balance September 30, 1897,			22,807 70
			$155,527 70

Schedule "A."

SUMMARY OF EXPENDITURES FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1897.

Adirondack Hatchery,	$4,223 51	
Beaverkill "	1,253 89	
Caledonia "	15,223 69	
Cold Spring "	8,779 71	
Fulton Chain "	6,306 50	
Pleasant Valley "	3,578 35	
Sacandaga "	2,940 04	
James Annin, Jr., Superintendent, salary,	2,500 00	
" " travelling expenses,	431 78	
Clayton Hatching Station,	1,969 63	
Catskill "	1,238 10	
Chautauqua "	830 55	
Constantia "	965 03	
Canandaigua "	797 98	
Collecting whitefish eggs, Lake Michigan,	1,014 50	
Removing fish from canal near Montezuma, and placing in Seneca River,	61 00	
Transportation of fish car on foreign roads,	137 28	
Expenses of Superintendent's office at Caledonia,	1,071 10	
Insurance on Hatcheries,	72 00	
		$53,394 64

HATCHERY ACCOUNTS.

Adirondack Hatchery:

1896.				
Oct.	F. & C. Crittenden & Co.,	liver,	$3 14	
	A. W. Marks,	labor,	47 50	
	Milo Otis,	"	45 00	
	M. A. Roberts,	labor and expenses,	19 00	
	W. D. Oviatt,	" "	22 94	
	John G. Roberts,	exp., R.R. fare, board, salary,	101 53	
				$239 11
Nov.	Walton Stark & Co.,	hardware and whip,	$9 10	
	American Net & Twine Co.,	netting and leads,	13 16	
	William Ames,	labor	43 75	
	Ames Boas,	board,	10 00	
	M. A. Roberts,	labor and expenses,	63 90	
	Justin Farmington,	" "	34 04	
	Joseph Otis,	team hire and labor,	7 90	
		Forward,	$181 85	$239 11

1896.		Brought forward,	$181 85	$239 11
Nov.	John G. Roberts,	postage, salary and expenses, .	116 44	
	Joseph Otis, Jr.,	labor, ...	37 50	
	A. W. Marks,	labor and expenses, . .	82 70	
	W. D. Oviatt,	labor, ...	62 00	
	Milo Otis,	"	54 25	
	F. & C. Crittenden & Co.,	liver, ...	2 03	
	E. M. Weston,	board, ...	26 00	
	Upper Saranac Association,	"	67 01	
				629 78
Dec.	Milo Otis,	labor, ...	$52 50	
	Joseph Otis, Jr.,	"	37 50	
	M. A. Roberts,	"	57 00	
	William Ames,	labor and expenses, . . .	5 58	
	W. D. Oviatt,	postage, labor and stationery, .	53 25	
	A. W. Marks,	labor and expenses, . . .	103 78	
	John G. Roberts,	postage, expenses, salary, board,	117 75	
	John E. Robinson,	labor, ...	33 00	
	M. Martin,	use of boat, ...	6 00	
	Alexander Micksanbag,	"	12 00	
	O. L. Duall,	"	6 00	
	William Cross,	"	15 00	
	F. & C. Crittenden & Co.,	liver, ...	2 46	
	L. S. See & Co.,	meat, sundries, etc . . .	28 30	
				530 12
1897.				
Jan.	Milo Otis,	labor, ...	$54 25	
	Joseph Otis, Jr.,	"	38 75	
	William Ames,	"	15 25	
	A. W. Marks,	labor and expenses, . . .	60 59	
	O. S. Lawrence,	hay and oats, ...	71 87	
	A. R. Fuller,	supplies, livery, labor, . .	96 10	
	John G. Roberts,	expenses, postage, R. R. fare, salary, etc., ...	92 50	
	Walton Starks & Co.,	tubing, stove pipes, stove, etc , .	13 30	
	M. A. Roberts,	labor and expenses, . . .	40 65	
				483 26
Feb.	Upper Saranac Association,	hardware, lumber, etc., . .	$10 51	
	A. W. Marks,	labor, ...	58 90	
	M. A. Roberts,	"	58 90	
	Milo Otis,	"	54 25	
	John G. Roberts,	R.R. fares, postage, salary, etc.	93 05	
	A. W. Marks,	July account (original voucher with July abstract), . .	58 90	
				334 51
			Forward,	$2,216 78

1897.		Brought forward,		$2,216 78
Mch.	Milo Otis,	labor, ...	$49 00	
	A. W. Marks,	"	51 30	
	M. A. Roberts,	"	53 20	
	John G. Roberts,	freight, exp., postage, salary, etc.	91 40	
				244 90
April	Eugene Keet,	harness, ...	$7 85	
	Walton Starks & Co.,	paint, hardware, etc., . .	10 60	
	F. & C. Crittenden & Co.,	liver, ...	2 95	
	A. W. Marks,	labor, ...	57 00	
	M. A. Roberts,	"	58 90	
	Milo Otis,	"	54 25	
	John G. Roberts,	exp., postage, sundries, salary,	95 55	
	Upper Saranac Association,	sand and blacksmithing, . .	5 50	
				292 60
May	Milo Otis,	labor and expenses, . . .	$55 50	
	M. A. Roberts,	" "	63 35	
	A. W. Marks,	" "	69 00	
	F. &. C. Crittenden & Co.,	liver, ...	6 63	
	J. G. Marks,	salary and expenses, . .	97 20	
				291 68
June	Joseph Otis, Jr.,	team work, ...	$3 50	
	L. A. Hood,	doctoring horse, . . .	13 00	
	F. & C. Crittenden & Co.,	liver, ...	7 39	
	A. W. Marks,	labor and expenses, . . .	65 15	
	Joseph Otis,	" "	44 50	
	M. A. Roberts,	" "	66 04	
	Milo Otis,	" "	60 50	
	John G. Roberts,	salary, freight and expenses, .	104 57	
				364 65
July	Sheelers Sons,	wire screen, ...	$24 96	
	Armor & Co.,	liver, ...	7 15	
	A. W. Marks,	labor, ...	28 50	
	Joseph Otis,	labor and expenses, . . .	18 06	
	M. A. Roberts,	labor, ...	57 00	
	Milo Otis,	"	52 50	
	John G. Roberts,	expenses, freight and salary, .	102 90	
	James Field & Co.,	American flag, . . .	9 96	
				301 03
Aug.	Milo Otis,	labor, ...	$54 25	
	M. A. Roberts,	"	58 90	
	John G. Roberts,	expenses, freight, salary, etc., .	96 50	
	Upper Saranac Association,	hardware, lumber, etc., . .	88 46	
	Armor & Co.,	liver, ...	7 96	
				306 07
		Forward,		$4,017 71

1897.			Brought forward,	$4,017 71
Sept.	Milo Otis,	labor, ...	$54 25	
	M. A. Roberts,	"	58 90	
	John G. Roberts,	freight, salary, etc., . .	92 65	
				205 80
	Total Adirondack, ...			$4,223 51

Beaverkill Hatchery:

1896.				
Oct.	M. R. Dodge,	livery and cartage, ...	$3 00	
	Charles Laraway,	wages, ...	4 50	
	H. E. Annin,	wages and other expenses, .	75 73	
				83 23
Nov.	H. W. Hawes,	board, ...	$10 12	
	M. R. Dodge,	livery, ...	19 50	
	E. A. Dodge,	work, ...	2 50	
	Charles Laraway,	salary, ...	21 00	
	H. E. Annin,	salary and expenses, . .	97 70	
				150 82
Dec.	James Fitzgerald,	coal, ...	$12 79	
	M. R. Dodge,	livery, ...	20 00	
	George Darrow,	board, self and Twist, . .	29 00	
	Willis Twist,	extra day work, . . .	40 50	
	E. A. Dodge,	" "	11 25	
	Charles Laraway,	salary, ...	45 00	
	H. E. Annin,	salary and expenses, . .	80 73	
	Stoddard Hammond,	brook trout eggs, . . .	192 00	
				431 27
1897.				
Jan.	Charles Laraway,	wages, ...	$46 50	
	H. E. Annin,	salary, etc., ...	85 52	
				132 02
Feb.	James Fitzgerald,	coal and cartage, ...	$9 10	
	Herbert C. Dodge,	sawdust and cartage, . .	3 40	
	Charles B. Laraway,	labor and expenses, . .	47 00	
				59 50
Mch.	Charles B. Laraway,	28 days' labor, $1.50 per day, .		42 00
April	James Fitzgerald,	coal and cartage, ...	$19 05	
	Charles B. Laraway,	labor, ...	46 50	
				65 55
May	Charles B. Laraway,	postage, ...	$0 50	
	" "	labor, ...	45 50	
				46 00
			Forward,	$1,010 39

1897.		Brought forward,		$1,010 39
June	M. R. Dodge,	livery, ...	$11 00	
	Willis Twist,	labor, ...	8 25	
	A. Green,	cartage, ...	5 00	
	Charles B. Laraway,	labor and expenses, . .	58 75	
				83 00
July	Charles B. Laraway,	30 days' labor, $1.75 per day, .		52 50
Aug.	" "	31 " " " .		54 25
Sept.	" "	31 " " " .		54 25
	Total Beaverkill,	. . . .		$1,254 39

Caledonia Hatchery:

1896.			
Oct.	Frank Redband,	salary and expenses, . .	$132 36
	George Stewart,	labor and expenses, . .	57 41
	John A. Upton,	" " . .	74 60
	William Johnson,	" " . .	52 50
	Sylvester Selleck,	labor, ...	49 50
	George H. Lawson,	"	57 00
	H. R. Cotchefer,	labor and expenses, . . .	44 50
	Alphonse Baldeck,	labor, ...	39 00
	William Curphey,	"	18 75
	William Ball,	carpenter, labor and expenses, .	25 56
	Grant Christie,	" " " .	6 95
	James Brown,	labor and expenses, . . .	40 00
	William Carruthers,	" "	23 25
	Neil Cooper,	" " with team, .	43 75
	James Melbourne,	" "	15 75
	James Cook,	" "	11 62
	Joseph Bartlett,	" "	13 50
	John Murray,	" "	13 87
	John Wood,	" "	14 25
	George Henderson,	" "	10 87
	Alfred Kime,	" "	6 37
	Patrick Carroll,	" "	3 00
	William McNaughton,	carpenter, ...	40 40
	Clarence McNaughton,	"	39 40
	Garrett McNaughton,	"	37 40
	Frank Langman,	mason labor, ...	12 50
	George Redband,	" "	25 00
	James Gill,	" "	31 50
	George Johnson,	mason, ...	18 75
	William Champ,	"	11 25
	Jamie C. Annin,	carting, ...	3 50
	R. Pullybank, Jr.,	carting, ...	42 00
		Forward,	$1,016 06

1896.		Brought forward,	$1,016 06	
Oct.	Gould & Nowlen,	plumbing,	126 63	
	W. J. Williams,	lumber,	113 68	
	Robert J. Aull,	labor and expenses (inspection at Buffalo),	4 80	
	Thomas Gallagher,	brooms,	5 00	
	Buffalo Hardwood Lumber Co.	lumber,	141 42	
	C. Dorflinger & Sons,	specimen jars,	11 05	
	John C. Pullybank,	cartage,	1 00	
	American Net & Twine Co.,	twine,	2 09	
	Wells Fargo & Co.,	express,	17 35	
	F. & C. Crittenden & Co.,	fish food,	33 18	
				$1,472 26
Nov.	Frank Redband,	salary and expenses,	$149 27	
	George Stewart,	labor and expenses,	55 85	
	John A. Upton,	" "	66 32	
	William Johnson,	labor,	54 25	
	Sylvester Selleck,	"	51 15	
	George H. Lawson,	"	58 90	
	H. R. Cotchefer,	labor and expenses,	53 25	
	Alphonse Baldeck,	labor,	40 50	
	William Curphey,	"	40 50	
	William Ball,	labor and expenses,	45 96	
	Grant Christie,.	" "	62 30	
	James Brown,	labor,	46 00	
	William Carruthers,	"	34 50	
	Cornelius Cooper,	team labor,	78 75	
	James Melbourne,	labor,	40 50	
	Joseph Bartlett,	"	40 50	
	John Murray,	"	22 50	
	John Wood,	"	36 90	
	George Henderson,	"	34 50	
	Alfred Kime,	"	40 50	
	Patrick Carroll,	"	32 78	
	William McNaughton,	"	54 00	
	Clarence McNaughton,	"	16 00	
	Garrett McNaughton,	"	16 00	
	George Redband,	"	57 13	
	James Gill,	mason,	68 55	
	George Johnson,	labor,	59 63	
	William Champ,	mason,	52 13	
	Jamie C. Annin,	carting cans, etc.,	5 00	
	A. Pullybank, Jr.,	team labor,	91 00	
	W. J. Williams,	lumber,	21 69	
	Robert Aull,	carpenter,	43 87	
	Buffalo Hardwood Lumber Co.	cypress lumber,	60 65	
	John C. Pullybank,	team labor and cartage,	32 75	
		Forward,	$1,664 08	$1,472 26

1896.		Brought forward,	$1,664 08	$1,472 26
Nov.	W. F. Lawson,	cartage, fish, etc.,	5 25	
	A. P. Campbell,	turpentine, oil, etc.,	11 28	
	Wilson & Moore,	sheep shears,	1 15	
	Patrick Freeman,	oak timber,	7 60	
	Frederick Wiedner,	"	2 68	
	Robert Morris,	labor,	39 00	
	F. & C. Crittenden & Co.,	fish food,	35 33	
	C. Klinck,	"	44 00	
	"	"	45 90	
	Wells Fargo & Co.,	express,	18 45	
	American Express Co.,	"	12 60	
	Howard Laidlaw,	labor,	29 03	
	Charles Simpson,	"	29 25	
	Alexander Mullin,	"	23 60	
	James Day,	"	11 00	
	McCabe Bros.,	fish food,	10 59	
	Salter Bros.,	tulip bulbs,	8 75	
	John Booman,	white lead, etc.,	37 77	
	McCabe Bros.,	stone,	62 00	
	W. D. Marks,	labor,	2 00	
				2,101 31
Dec.	Frank Redband, foreman,	salary and expenses,	$114 29	
	George Stewart,	" "	52 50	
	William Johnson,	" "	26 25	
	Sylvester Selleck,	" "	49 50	
	George H. Lawson,	" "	57 00	
	H. R. Cotchefer,	" "	46 05	
	Alphonse Baldeck,	" "	43 50	
	William Curphey,	" "	30 00	
	Grant Christie,	" "	62 94	
	James Melbourne,	" "	6 00	
	Joseph Bartlett,	" "	6 00	
	Alfred Kime,	" "	6 00	
	William McNaughton,	" "	18 50	
	William Champ,	" "	6 88	
	Robert J. Aull,	" "	20 70	
	Howard Laidlaw,	" "	6 00	
	Chas. Simpson,	" "	6 00	
	James Day,	" "	10 00	
	Alexander Mullin, Jr.,	" "	16 00	
	Robert McArthur,	salary and sand,	89 25	
	Jamie C. Annin,	carting,	9 75	
	W. F. Lawson,	"	2 00	
	John C. Pullybank,	"	4 00	
	R. Pullybank, Jr.,	"	3 75	
		Forward,	$692 86	$3,573 57

1896.		Brought forward,	$692 86	$3,573 57
Dec.	George Stewart,	shop work, ...	4 50	
	William Nichols,	"	4 75	
	Richard Reid,	"	26 05	
	George McKay,	use of derrick, . . .	19 50	
	C. Klinck,	fish food, ...	40 10	
	F. & C. Crittenden & Co.,	fish food, ...	35 67	
	Walker & Matteson,	hardware, ...	274 73	
	Gould & Nowlen,	"	64 52	
	Chamberlain Rubber Store,	tubing, ...	4 50	
	C. Dorflinger,	hatching jars, ...	47 10	
	Frost & Co.,	trees for State grounds, . .	26 25	
	A. H. Collins,	printing tags, ...	3 00	
	W. F. Williams,	lumber, ...	3 78	
	A. Beekman,	"	132 30	
	Wells Fargo & Co.,	express, ...	21 25	
	American Express Co.,	"	49 75	
	Whitmore, Rauber & Vicimus,	cement and labor, . . .	1,337 65	
				2,788 26
1897.				
Jan.	Frank Redband, foreman,	salary and expenses, . .	$92 25	
	George Stewart,	labor and expenses, . .	59 95	
	John A. Upton,	" "	38 68	
	William Johnson,	" "	54 25	
	Sylvester Selleck,	" "	51 15	
	George H. Lawson,	" "	58 90	
	H. R. Cotchefer,	" "	50 25	
	Alphonse Baldeck,	" "	46 50	
	William Curphey,	" "	26 88	
	William McNaughton,	" "	15 00	
	Jamie C. Annin,	carting, ...	2 75	
	C. Klinck,	fish food, ...	34 20	
	F. & C. Crittenden & Co.,	"	30 88	
	McCabe Bros.,	"	7 80	
	Scheeler's Sons,	wire cloth, ...	3 75	
	Andrew Guthrie,	cedar posts, ...	3 10	
	John C. Pullybank,	carting, ...	9 00	
	Robert J. Aull,	carpenter, ...	2 81	
	W. F. Samson,	cutlery, ...	7 75	
	U. S. Express Co.,	express, ...	14 80	
	W. J. Williams,	lumber, ...	17 87	
	Grant Christie,	labor and expenses, . .	108 47	
	Wells Fargo & Co.,	express, ...	3 15	
	American Express Co.,	"	8 95	
	Richard Pullybank, Jr.,	carting, ...	2 75	
	A. P. Campbell,	oil, etc., ...	7 05	
				$758 89
			Forward,	$7,120 72

1897.		Brought forward,		$7,120 72
Feb.	Frank Redband, foreman,	salary and expenses,	$100 37	
	George Stewart,	labor and expenses,	55 00	
	John A. Upton,	" "	85 26	
	William Johnson,	" "	54 25	
	Sylvester Selleck,	" "	51 15	
	George H. Lawson,	" "	58 90	
	H. R. Cotchefer,	" "	50 72	
	Alphonse Baldeck,	" "	46 50	
	William McNaughton,	" "	29 60	
	Grant Christie,	" "	30 25	
	Robert J. Aull,	" "	47 40	
	William Ball,	" "	41 50	
	Jamie C. Annin,	carting,	4 00	
	J. C. Pullybank,	"	1 00	
	R. Pullybank, Jr.,	"	5 00	
	C. Klinck,	fish food,	32 50	
	F. & C. Crittenden & Co.,	"	33 00	
	Walker & Matteson,	hardware,	219 28	
	Thomas Gallagher,	brooms,	5 50	
	William B. Morse & Sons,	lumber,	91 21	
	W. J. Williams,	"	199 32	
	U. S. Express Co.,	express,	15 50	
				1,257 21
Mar.	Frank Redband, foreman,	salary and expenses,	$104 16	
	George Stewart,	labor and expenses,	60 20	
	John A. Upton,	" "	41 15	
	William Johnson,	" "	49 44	
	Sylvester Selleck,	" "	46 20	
	George H. Lawson,	" "	53 20	
	H. R. Cotchefer,	" "	52 25	
	William Ball,	" "	22 00	
	Robert J. Aull,	" "	46 00	
	Randall R. Brown,	" "	38 37	
	Alexander Mullin, Jr.,	" "	7 70	
	Grant Christie,	" "	53 05	
	McCabe Bros.,	fish food,	10 88	
	C. Klinck,	"	31 20	
	F. & C. Crittenden & Co.,	"	26 92	
	Jamie C. Annin,	carting,	12 50	
	W. F. Lawson,	"	4 50	
	Richard Pullybank, Jr.,	"	4 00	
	William B. Morse & Sons,	lumber,	77 92	
	Kroner & Lape,	"	11 95	
	W. J. Williams,	"	42 82	
	Richard Reid,	iron and labor,	6 58	
		Forward,	$802 99	$8,377 93

1897.		Brought forward,	$802 99	$8,377 93
Mar.	American Express Co.,	express,	5 95	
	U. S. Express Co.,	"	14 45	
	Walker & Matteson,	hardware,	65 56	
	Richard T. Ford,	repairing heating,	32 64	
	S. A. Lattimore,	chemical examination,	5 00	
	Scheeler's Sons,	wire cloth,	9 58	
				936 17
April	Frank Redband, foreman,	salary and expenses,	$97 02	
	George Stewart,	labor and expenses,	67 45	
	John A. Upton,	" "	59 25	
	William Johnson,	" "	54 25	
	Sylvester Selleck,	" "	33 80	
	George H. Lawson,	" "	58 90	
	H. R. Cotchefer,	" "	54 93	
	William Ball,	" "	8 12	
	Robert J. Aull,	" "	15 60	
	Randall R. Brown,	" "	60 79	
	M. G. Craft,	" "	44 89	
	Charles Boehm,	" "	9 75	
	Grant Christie,	" "	19 40	
	Jamie C. Annin,	carting,	17 50	
	W. F. Lawson,	"	4 50	
	F. & C. Crittenden & Co.,	fish food,	29 57	
	C. Klinck,	"	35 10	
	American Express Co.,	express,	3 65	
	U. S. Express Co.,	"	17 25	
	Philip Becker & Co.,	glass,	10 20	
	J. E. Harvey,	repairing fish cans,	6 72	
	J. M. Matteson & Co.,	hardware,	34 53	
	Sheeler's Sons,	wire cloth,	3 80	
	W. H. Garbutt,	ice,	48 00	
				794 97
May	Frank Redband, foreman,	labor and expenses,	$102 10	
	George Stewart,	" "	69 63	
	John A. Upton,	" "	75 88	
	William Johnson,	" "	52 50	
	Sylvester Selleck,	" "	51 85	
	George H. Lawson,	" "	57 00	
	H. R. Cotchefer,	" "	50 80	
	M. G. Craft,	" "	47 50	
	Addison Kingsbury,	" "	39 00	
	Grant Christie,	" "	18 05	
	R. J. Aull,	" "	15 88	
	William McNaughton,	" "	8 20	
	William Ball,	" "	5 00	
		Forward,	$593 39	$10,109 07

1897.		Brought forward,	$593 39	$10,109 07
May	W. W. Roberts,	labor, trees and planting, . .	15 60	
	Wilson & Moore,	lead and oil, ...	17 00	
	Sheeler's Sons,	wire cloth, ...	4 62	
	C. Klinck,	fish food, ...	36 50	
	F. & C. Crittenden & Co.,	"	29 90	
	McCabe Bros.,	"	5 18	
	Jamie C. Annin,	carting, ...	15 25	
	W. T. Lawson,	"	11 00	
	John C. Pullybank,	"	6 75	
	A. P. Campbell,	sundries, ...	6 84	
	J. E. Harvey,	repairing fish cans, . . .	6 85	
	Wells Fargo & Co.,	express, ...	42 38	
	U. S. Express Co.,	"	16 35	
				807 61
June	Frank Redband, foreman,	salary and expenses, . . .	$97 50	
	George Stewart,	labor and expenses, . . .	56 55	
	John A. Upton,	" "	8 00	
	William Johnson,	" "	54 25	
	Sylvester Selleck,	" "	56 55	
	George H. Lawson,	" "	62 00	
	H. R. Cotchefer,	" "	23 25	
	N. G. Craft,	" "	51 15	
	Addison Kingsbury,	" "	40 30	
	Charles Boehm,	" "	26 10	
	Peter P. Campbell,	" "	22 75	
	Mary Cooper,	team and labor, ...	60 90	
	William Masten,	labor and expenses, . . .	22 35	
	Alexander Amond,	" "	23 85	
	W. D. Marks,	" "	10 25	
	"	" "	30 95	
	Alexander Mullin, Jr.,	" "	21 80	
	James Day,	" "	22 40	
	Jamie C. Annin,	carting, ...	13 00	
	W. F. Lawson,	"	1 50	
	John Pullybank,	"	18 25	
	F. & C. Crittenden & Co.,	fish food, ...	30 76	
	A. Klinck,	"	46 00	
	E. H. Smith,	paper rooms in St. house, .	9 00	
	J. M. Matteson & Co.,	hardware, ...	70 90	
	James Field Co.,	American flag, ...	9 96	
	A. K. Fowler,	wall paper, etc., ...	13 30	
	J. E. Harvey,	repairing cans, ...	2 10	
	U. S. Express Co.,	express, ...	16 95	
	Scheeler's Sons,	wire cloth, ...	23 17	
				945 79
			Forward,	$11,862 47

1897.			Forward,	$11,862 47
July	Frank Redband,	salary and expenses,	$108 83	
	George Stewart,	labor and expenses,	61 25	
	George H. Lawson,	"	60 00	
	John A. Upton,	"	79 28	
	William Johnson,	"	52 50	
	Sylvester Selleck,	"	52 50	
	H. R. Cotchefer,	"	52 50	
	M. G. Craft,	"	49 50	
	Addison Kingsbury,	"	39 00	
	Charles Boehm,	"	36 00	
	Peter P. Campbell,	"	38 15	
	Cornelius Cooper,	labor with team,	78 05	
	Wm. Masten,	labor,	32 25	
	Alexander Amond,	"	36 00	
	W. D. Marks,	labor and expenses,	37 45	
	R. A. Menzie,	" "	3 75	
	William McNaughton,	" "	5 00	
	Grant Christie,	" "	39 65	
	Jamie C. Annin,	expenses, carting and labor,	35 85	
	John C. Pullybank,	carting,	11 75	
	R. Pullybank, Jr.,	"	2 50	
	"	"	3 00	
	W. F. Lawson,	"	6 00	
	John F. Ward,	florist,	36 44	
	A. P. Campbell,	sundries,	6 10	
	W. J. Williams,	lumber,	11 35	
	Delancey A. Cameron,	"	30 58	
	U. S. Express Co.,	express,	17 30	
	C. Klinck,	fish food,	56 00	
	F. & C. Crittenden & Co.,	"	35 28	
	McCabe Bros.,	"	6 80	
				1,120 61
Aug.	Frank Redband, foreman,	salary and expenses,	$98 13	
	George Stewart,	labor,	54 25	
	George Lawson,	"	62 00	
	John A. Upton,	labor and expenses,	65 85	
	William Johnson,	" "	54 25	
	Sylvester Selleck,	" "	54 25	
	H. R. Cotchefer,	" "	56 20	
	M. G. Craft,	" "	51 15	
	Addison Kingsbury,	" "	40 50	
	Charles Boehm,	" "	35 25	
	Peter P. Campbell,	" "	38 50	
	Cornelius Cooper,	" with team,	75 25	
	William Masten,	"	33 75	
		Forward,	$719 33	$12,983 08

1897.		Brought forward,	$719 33	$12,983 08
Aug.	Alexander Amond,	labor and expenses,	34 50	
	W. P. Babcock,	"	26 78	
	Charles Christie,	"	25 20	
	William McNaughton,	labor and expenses,	26 50	
	E. H. Smith,	painting,	9 50	
	Jamie C. Annin,	carting fish and cans,	3 75	
	R. Pullybank, Jr.,	carting,	13 72	
	John C. Pullybank,	"	9 25	
	J. E. Harvey,	agent repairing cans,	3 20	
	F. & C. Crittenden & Co.,	fish food,	37 99	
	C. Klinck,	"	59 40	
	Union Car Co.,	repairs for car,	10 95	
	DeLancey A. Cameron,	lumber,	61 83	
	U. S. Express Co.,	express,	18 40	
	Charles A. Taylor,	travelling expenses,	19 07	
				1,079 37
Sept.	Frank Redband, foreman,	salary and expenses,	$98 31	
	George Stewart,	labor,	54 25	
	George H. Lawson,	"	62 00	
	John A. Upton,	labor and expenses,	73 35	
	William Johnson,	" "	54 25	
	Sylvester Selleck,	" "	54 25	
	H. R. Cotchefer,	" "	54 75	
	M. G. Craft,	" "	51 60	
	Addison Kingsbury,	labor,	39 00	
	Charles Boehm,	"	37 20	
	Peter P. Campbell,	"	26 78	
	Cornelius Cooper,	"	86 80	
	William Masten,	"	32 70	
	Alexander Amond,	"	37 20	
	Grant Christie,	labor and expenses,	78 50	
	W. D. Marks,	" "	17 00	
	W. Palmer Babcock,	labor,	34 50	
	Jamie C. Annin,	carting,	16 00	
	W. F. Lawson,	"	2 25	
	R. Pullybank, Jr.,	"	1 00	
	R. Pullybank, Sr.,	"	10 35	
	F. & C. Crittenden & Co.,	fish food,	40 58	
	C. Klinck,	"	57 20	
	McCabe Bros.,	"	9 33	
	J. E. Harvey,	repairing cans,	6 45	
	W. A. Holden,	coal,	101 52	
	American Express Co.,	express,	6 20	
	U. S. Express Co.,	"	17 92	
				1,161 24
	Total Caledonia,			$15,223 69

Cold Spring Hatchery:

1896.				
Oct.	M. Aorams,	fish food,	$113 60	
	J. C. Totten,	express on fish food,	18 35	
	Estey Wire Works Co.,	egg trays,	33 54	
	Hugh Campbell,	transportation fish cans,	30 00	
	A. P. Dodge,	sundries,	6 52	
	William Stoyle,	"	7 00	
	Mrs. J. H. Lockwood,	building new ponds,	3 75	
	Elwood Abrams,	sundries,	6 81	
	E. A. Cooper,	travel and labor,	70 27	
	James Wheeler,	cartage,	10 00	
	Silas D. Wood,	labor on new ponds,	34 50	
	O. V. Rogers,	" "	52 50	
	John T. Mahan,	" "	45 50	
	Peter Gorman,	" "	52 50	
	F. Van Ausdall,	" "	52 50	
	James Otis,	looking for horse,	3 00	
	C. H. Walters,	salary and expenses,	92 70	
	J. C. Totten,	cartage,	4 00	
	Richard Reid,	one-horse wagon,	40 00	
				$677 04
Nov.	E. L. Hogan,	transferring cans fish,	$75 00	
	Selah D. Tillotson,	use one horse,	4 45	
	E. B. Dusenbury, Jr.,	food for horse,	5 15	
	M. Abrams,	fish food,	94 80	
	William R. Bingham,	preserving fish food,	4 86	
	E. A. Cooper,	travel and labor,	94 51	
	F. Van Ausdall,	labor, feeding fish,	54 25	
	Peter Gorman,	labor,	54 25	
	John T. Mahan,	"	54 25	
	O. V. Rogers,	"	54 25	
	C. H. Walters,	salary and expenses,	94 83	
	J. C. Totten, agent L. I. Exp.,	freight,	25 19	
				615 79
Dec.	W. H. Stoyle,	sundries,	$6 65	
	A. P. Dodge,	hardware,	3 90	
	Crane Company,	plumbing,	11 64	
	M. Abrams,	fish food,	108 00	
	J. C. Totten,	freight and expenses,	16 75	
	E. A. Cooper,	travel and labor,	58 57	
	O. V. Rogers,	labor,	52 50	
	F. Van Ausdall,	"	52 50	
	Peter Gorman,	"	52 50	
	John T. Mahan,	"	52 50	
		Forward,	$415 51	$1,292 83

1896.		Brought forward,	$415 51	$1,292 83
Dec.	William McNaughton,	labor,	28 00	
	C. H. Walters,	salary and expenses,	95 93	
				539 44
1897.				
Jan.	M. Abrams,	fish food,	$119 80	
	J. C. Totten,	express on food,	20 65	
	F. T. O'Neill,	coal for hatchery,	33 00	
	James T. Demilt,	grain for horse,	10 90	
	John Lindsay,	treating horse,	6 50	
	Wm. McNaughton,	carpenter,	34 76	
	W. Milton Wood,	lumber for barn,	328 86	
	W. H. Stoyle,	sundries,	12 45	
	A. P. Dodge,	sundries for barn,	11 76	
	E. A. Cooper,	travel and labor,	75 38	
	O. V. Rogers,	labor,	54 25	
	John T. Mahan,	"	54 25	
	F. Van Ausdall,	labor, feeding fish,	54 25	
	Peter Gorman,	labor,	54 25	
	C. H. Walters,	salary and expenses,	114 65	
				985 71
Feb.	F. Nichols,	plumbing,	$42 86	
	M. Abrams,	fish food,	97 75	
	J. C. Totten,	freight on food,	29 40	
	E. B. Dusenbury, Jr.,	supplies for horse,	11 01	
	William T. Lockwood,	sundries,	6 75	
	E. A. Cooper,	travel and labor,	78 82	
	Peter Gorman,	" "	83 27	
	O. V. Rogers,	labor,	54 25	
	F. Van Ausdall,	"	54 25	
	John T. Mahan,	"	54 25	
	C. H. Walters,	salary and expenses,	93 50	
				606 11
Mch.	M. Abrams,	fish food,	$77 18	
	J. C. Totten,	express and freight,	13 45	
	F. T. O'Neill,	coal,	30 14	
	The Long Islander,	shipping tags,	5 00	
	A. P. Dodge,	hardware,	8 23	
	Richard T. Ford,	heating hatchery,	295 00	
	William R. Bingham,	filling ice house,	68 75	
	E. A. Cooper,	travel with fish,	99 14	
	Peter Gorman,	" "	107 73	
	O. V. Rogers,	labor,	49 00	
	F. Van Ausdall,	"	49 00	
	John T. Mahan,	"	49 00	
	C. H. Walters,	salary and expenses,	96 05	
				947 67
			Forward,	$4,371 76

1897.		Brought forward,		$4,371 76
April	M. Abrams,	fish food,	$77 70	
	J. C. Totten,	freight,	21 35	
	J. W. Matteson,	fish cans,	28 50	
	E. D. Dusenbury, Jr.,	hay for horse,	9 79	
	Wm. R. Bingham,	covering ice,	4 95	
	Peter Gorman,	travel and labor,	148 27	
	E. A. Cooper,	" "	97 41	
	John T. Mahan,	" "	63 34	
	F. Van Ausdall,	" "	55 72	
	O. V. Rogers,	labor,	54 25	
	Fred. Gardiner,	"	9 00	
	C. H. Walters,	salary and expenses,	96 90	
				667 18
May	L. M. Abrams,	fish food,	$86 63	
	J. C. Totten,	freight on food,	14 40	
	F. T. O'Neill,	coal,	9 30	
	James T. Demilt,	grain for horse,	20 70	
	William T. Lockwood,	sundries,	4 00	
	Fred. E. Gardiner,	labor,	36 00	
	Peter Gorman,	labor and travel,	154 62	
	E. A. Cooper,	" "	80 64	
	John T. Mahan,	" "	108 32	
	F. Van Ausdall,	labor,	52 50	
	O. V. Rogers,	"	52 50	
	C. H. Walters,	salary and expenses,	96 77	
				716 38
June	M. Abrams,	fish food,	$95 90	
	J. C. Totten,	freight and express,	19 85	
	Alexander Gardiner,	new ponds,	15 00	
	A. P. Dodge,	sundries,	18 95	
	W. M. Wood,	new ponds,	149 68	
	John J. Demarest,	fixtures for engine,	4 00	
	Peter Gorman,	travel and labor,	66 33	
	E. A. Cooper,	labor,	42 00	
	O. V. Rogers,	"	35 00	
	John T. Mahan,	"	54 25	
	Shepard Keene,	"	7 50	
	F. Van Ausdall,	"	54 25	
	Richard Cronin,	"	21 00	
	Daniel Gardiner,	"	21 00	
	Joseph McMenomen,	"	4 50	
	James Wheeler,	cartage,	26 25	
	A. H. Mahan,	labor,	7 50	
	C. H. Walters,	salary and expenses,	107 36	
				750 32
		Forward,		$6,505 64

1897.			Brought forward,	$6,505 64
July	M. Abrams,	fish food,	$103 95	
	J. C. Totten,	freight,	30 82	
	George Thompson,	shad fishing,	30 00	
	W. M. Spurge,	board and lodging,	45 02	
	H. W. Conn,	lobster work,	25 00	
	Wm. Pepper & Bro.,	"	26 56	
	Crane Co.,	plumbing,	13 86	
	George G. Conklin,	garden hose,	6 25	
	John J. Demarest,	lobster work,	14 70	
	W. H. Stoyle,	sundries,	9 41	
	F. Nichols,	lobster hatching,	14 75	
	Arthur Mahan,	labor,	16 50	
	James Wheeler,	carting,	18 75	
	Richard Cronin,	labor,	37 50	
	Daniel G. Gardiner,	"	33 00	
	Joseph McMenomen,	"	16 50	
	E. Bum,	"	18 00	
	E. A. Cooper,	"	53 25	
	Peter Gorman,	labor and travel,	60 85	
	John T. Mahan,	" "	58 28	
	O. V. Rogers,	" "	52 50	
	F. Van Ausdall,	" "	52 50	
	C. H. Walters,	salary and expenses,	95 96	
				833 91
Aug.	M. Abrams,	fish food,	$120 93	
	J. C. Totten,	freight,	20 85	
	C. B. Dusenbury, Jr.,	supplies for horse,	11 84	
	James T. Demilt,	" "	17 30	
	A. P. Dodge,	sundries,	4 96	
	Wm. O'Hara,	new flume in pond,	16 00	
	Alexander S. Gardiner,	" "	5 00	
	William T. Lockwood,	sundries,	4 10	
	W. W. Wood,	new flume, etc., in pond,	97 73	
	S. D. Tillotson,	supplies for horse,	2 25	
	Bingham & Brush,	supplies for lobster hatchery,	10 97	
	Peter Morton,	supplies, lobster eggs,	10 00	
	Frederick Mortenson,	lobster eggs,	10 00	
	Daniel J. Gardiner,	labor,	33 00	
	Richard Cronin,	"	36 00	
	Peter Gorman,	"	20 12	
	E. A. Cooper,	"	54 25	
	J. T. Mahan,	"	54 25	
	F. Van Ausdall,	"	54 25	
	O. V. Rogers,	"	54 25	
	C. H. Walters,	"	95 60	
				733 65
			Forward,	$8,073 20

1897.		Brought forward,		$8,073 20
Sept.	M. Abrams,	fish food,	$110 43	
	J. C. Totten,	freight,	18 80	
	W. W. Wood,	lumber, ponds,	119 80	
	William Bingham,	cement, ponds,	12 75	
	William O'Hara,	post for ponds,	20 00	
	Adolphus Ford,	lobster eggs,	10 00	
	F. T. O'Neill,	tar for troughs,	7 49	
	E. A. Cooper,	labor and travel,	69 24	
	Richard Cronin,	labor,	39 00	
	James Wheeler,	carting,	22 50	
	John T. Mahan,	labor,	54 25	
	Peter Gorman,	"	19 25	
	F. Van Ausdall,	"	54 25	
	O. V. Rogers,	"	54 25	
	C. H. Walters,	salary and expenses,	94 50	
				706 51
	Total Cold Spring,			$8,779 71

Fulton Chain Hatchery:

1896.				
Oct.	Dodge & Snyder,	paints and oils,	$10 95	
	Charles Seymour,	5 days' labor,	10 00	
	W. H. Burke,	30 days' labor,	57 00	
	F. C. Marks,	labor,	41 80	
	William Huser,	"	21 00	
	Phillip Christy,	labor with team,	10 00	
	Jack Rivitt,	labor,	6 00	
	E. L. Marks,	salary,	90 00	
				$246 75
Nov.	American Net and Twine Co.,	cordage,	$10 22	
	George A. Clark,	hercules powder, caps and fuse,	13 85	
	Whitmore, Rauber & Viscinus,	5 barrels cement,	13 75	
	J. B. Thompson,	dynamite,	12 50	
	Nicholas Ginther,	freight and express,	29 96	
	George Dies & Son,	lumber, etc.,	138 79	
	J. H. Harvey,	hardware,	23 46	
	Charles Lyman,	labor,	27 50	
	Phillip Christy,	labor with team,	42 00	
	Lazare White,	labor,	43 00	
	Adam Tunis,	"	45 00	
	John Rivitt,	"	25 50	
	William Huser,	"	46 50	
		Forward,	$472 03	$246 75

1896.		Brought forward,	$472 03	$246 75
Nov.	Theodore Lablank,	labor, ...	13 56	
	F. C. Marks,	"	58 90	
	William H. Burke,	"	58 90	
	H. B. Kendall,	labor and expenses, . .	53 78	
	E. L. Marks.	salary and expenses, . .	96 12	
				753 29
Dec.	F. & C. Crittenden & Co.,	fish food, ...	$2 88	
	E. Dorflinger,	hatching jars, ...	31 40	
	Charles Miller & Son,	iron fuel pipes, ...	86 10	
	Nicholas Ginther,	freight and express, . . .	18 78	
	Adam Tunis,	labor, ...	17 50	
	Lazare White,	"	20 50	
	William Huser,	"	10 00	
	William Ball,	labor and expenses, . .	84 19	
	F. C. Marks,	labor, ...	57 00	
	H. B. Kendall,	"	45 00	
	William H. Burke,	"	57 00	
	E. L. Marks,	salary and expenses, . .	99 33	
				529 68
1897.				
Jan.	George Deis & Son,	lumber and planing, . . .	$73 00	
	" "	wood, ...	9 00	
	W. S. Decamp,	timber, ...	42 15	
	N. Ginther,	express and freight, . .	20 75	
	F. & C. Crittenden & Co.,	fish food, ...	6 81	
	" "	"	5 89	
	Charles C. Kellogg,	express, ...	92 64	
	Walker and Matteson,	gate valves and tinware, . .	31 83	
	William Ball,	carpenter, ...	66 59	
	W. W. Hough,	oil, ...	4 73	
	Mrs. Frederick Hess,	board, ...	30 00	
	Phillip Christy,	labor with team, ...	5 00	
	J. A. Harvey,	hardware, ...	7 62	
	D. A. Fraule,	stove wood, ...	21 50	
	William H. Burke,	labor and expenses, . .	67 03	
	H. B. Kendall,	labor, ...	46 50	
	F. C. Marks,	"	58 90	
	E. L. Marks,	salary and expenses, . .	97 07	
				687 01
Feb.	Charles Miller & Son,	iron pipe, ...	$40 20	
	F. & C. Crittenden & Co.,	fish food, ...	4 25	
	Sabine Harvey,	stove, ...	34 00	
	Walker & Wilkinson,	tinware, ...	2 25	
	Scheeler & Sons,	wire screens, ...	11 55	
	Adam Fennis,	cartage, ...	7 50	
		Forward,	$99 75	$2,216 73

1897.		Brought forward,	$99 75	$2,216 73
Feb.	N. Ginther,	express and cartage, . .	13 54	
	H. P. Kendall,	labor, ...	46 50	
	W. H. Burke,	"	58 90	
	F. C. Marks,	"	47 50	
	H. E. Annin,	labor and expenses, . . .	122 26	
	Charles Miller & Son,	hardware, ...	67 60	
	F. C. Marks,	July acct. voucher with July abst.,	58 90	
				514 95
Mch.	F. & C. Crittenden & Co.,	fish food, ...	$7 01	
	Nicholas Ginther,	expenses and cartage, . .	5 45	
	F. C. Marks,	labor, ...	53 20	
	Harry Kendall,	"	42 00	
	W. H. Burke,	labor and expenses, . . .	53 46	
	H. E. Annin,	salary and expenses, . .	96 55	
				257 67
April	J. A. Harvey,	paint brushes, etc., . . .	$6 25	
	J. M. Matteson & Co.,	fish cans, ...	19 00	
	George Deis & Son,	lumber, ...	18 14	
	Parson & Co.,	oars, varnish, etc., . . .	4 73	
	F. & C. Crittenden & Co.,	fish food, ...	7 64	
	Adam Fennis,	board, ...	3 00	
	Nicholas Ginther,	cartage and express, . .	20 68	
	Dodge & Snyder,	oil, etc., ...	3 85	
	Harry P. Kendall,	labor, ...	46 50	
	F. C. Marks,	"	60 31	
	M. H. Burke,	"	61 55	
	H. E. Annin,	salary, etc., ...	118 10	
				369 75
May	Scheeler & Sons,	wire cloth, ...	$12 00	
	F. & C. Crittenden & Co.,	fish food, ...	3 39	
	Nicholas Ginther,	cartage, ...	26 00	
	F. C. Marks,	labor, ...	57 00	
	W. H. Burke,	labor and expenses, . . .	64 95	
	H. B. Kendall,	labor, ...	45 50	
	H. E. Annin,	salary and expenses, . .	93 00	
				301 84
June	George Deis & Son,	lumber, ...	$27 32	
	F. & C. Crittenden & Co.,	fish food, ...	8 01	
	Sabine Harvey,	plumbing, ...	24 31	
	"	nails, etc., ...	12 65	
	Jeannette E. Harvey,	wheelbarrows, etc., . . .	10 40	
	N. Ginther,	carting, ...	26 67	
	William Ball,	carpenter, ...	50 49	
	Adam Fennis,	labor, ...	18 00	
	L. White,	"	17 00	
		Forward,	$194 85	$3,660 94

1897.			Brought forward,	$194 85	$3,660 94
June	A. B. Main,	labor,		10 00	
	Harry Kendall,	"		54 25	
	F. C. Marks,	labor and expenses,		59 40	
	William Burke,	" "		62 65	
	H. E. Annin,	salary and expenses,		97 70	
					478 85
July	F. &. C. Crittenden & Co.,	fish food,		$9 79	
	George Deis & Son,	lumber,		35 52	
	Charles Kellogg Sons Co.,	"		264 66	
	Charles Miller & Son,	plumbing,		22 29	
	J. D. Wells Son & Co.,	sheets and pillow cases,		4 14	
	Sabone Harvey,	tin, nails, etc.,		9 23	
	Nicholas Ginther,	cartage, etc.,		36 83	
	Charles Wood,	carpenter,		7 50	
	William Ball,	"		88 12	
	L. White,	labor and expenses,		53 00	
	Adam Fennis,	" "		49 50	
	F. C. Marks,	labor, hatchery, etc.,		53 20	
	William Burke,	labor,		58 50	
	Harry Kendall,	"		52 50	
	H. E. Annin,	salary and expenses,		100 92	
					845 70
Aug.	S. H. Budlong & Son,	fish food,		$9 14	
	Scheeler & Sons,	wire cloth,		13 50	
	Frank Riley,	florist,		8 00	
	Allendorf & Porter,	furniture,		44 15	
	Dodge & Snyder,	paints and oils,		31 45	
	J. D. Matteson & Co.,	tinware and exp.,		4 79	
	Sabine & Harvey,	hardware,		21 44	
	Charles Miller & Son,	iron pipe, etc.,		84 41	
	Charles Kellogg Sons Co.,	lumber,		68 77	
	John Sprague,	mason work,		7 20	
	Janette E. Harvey,	nails, paint, etc.,		9 17	
	E. F. Abbott,	salt and grass seed,		9 50	
	George Deis & Son,	lumber,		35 69	
	Armor & Co.,	liver,		9 59	
	Alvin Brawley,	extra carpenter,		35 00	
	William Ball,	expenses carpenter,		68 92	
	Adam Tennis,	labor, etc.,		46 90	
	L. White,	extra labor,		50 00	
	F. C. Marks,	labor, hatchery,		58 90	
	William Burke,	"		58 90	
	H. B. Kendall,	"		54 25	
	H. E. Annin,	salary and expenses,		125 19	
					854 86
				Forward,	$5,840 35

1897.			Brought forward,		$5,840 35
Sept.	Dodge & Snyder,	lead, etc.,	$10 72		
	George Deis & Son,	lumber, etc.,	55 73		
	Adam Tennis,	labor,	48 00		
	L. White,	"	48 00		
	N. Ginther,	July acct., exp., labor and freight,	15 97		
	"	August " " "	19 08		
	H. B. Kendall,	labor,	54 25		
	William H. Burke,	"	58 90		
	F. C. Marks,	"	58 90		
	H. E. Annin,	salary and expenses,	95 60		
					466 15
	Total Fulton Chain,				$6,306 50

Pleasant Valley Hatchery:

1896.				
Oct.	Brownell & Co.,	hardware and supplies,	$30 69	
	R. R. Flynn,	salt,	13 60	
	Grant Christie,	labor and expenses,	54 26	
	William Ball,	" "	49 05	
	R. Buckley,	general work,	16 50	
	W. D. Oviatt,	labor,	49 50	
	A. Beekman,	lumber,	39 07	
	Kirkham & Platt,	"	90 69	
	Scheeler & Sons,	wire cloth,	2 85	
	Frederick C. Hunniston,	labor at hatchery,	52 50	
	Herbert Hunniston,	" "	22 50	
	O. S. Johnson,	labor,	39 00	
	Gaylon Johson,	"	39 00	
	Henry Garvey,	"	37 50	
	Ambrose Booth,	"	36 00	
	Simon W. Dillon,	labor with team,	61 50	
	Frederick J. Dillon,	carpenter,	33 75	
	R. Cotchefer,	expenses and services,	87 30	
				$755 26
Nov.	Frederick C. Hunniston,	labor at hatchery,	$52 50	
	Herbert Hunniston,	" "	22 50	
	O. S. Jóhnson,	general work,	20 25	
	F. & C. Crittenden & Co.,	fish food,	21 31	
	" "	"	17 39	
	Gould & Knowlten,	plumbing,	49 69	
	R. R. Flynn & Co.,	salt,	8 50	
	R. Cotchefer,	expenses and services,	87 28	
				279 42
			Forward,	$1,034 68

1896.			Brought forward,	$1,034 68
Dec.	Brownell & Co.,	hardware, etc.,	$9 30	
	Frost & Co.,	shrubbery,	7 50	
	T. Purdy,	sign painting,	9 00	
	M. Bowes & Co.,	coal for hatchery,	11 00	
	Frederick C. Hunniston,	labor at hatchery,	54 25	
	Herbert Hunniston,	" "	23 25	
	R. R. Flynn & Co.,	salt,	4 25	
	Grant Christie,	labor and expenses,	49 49	
	Kirkham & Platt,	repairing and lumber,	9 74	
	O. S. Johnson,	labor, miscellaneous,	6 00	
	R. Cotchefer,	expenses and services,	83 35	
				267 13
1897.				
Jan.	F. & C. Crittenden & Co.,	fish food,	$26 07	
	" "	"	19 65	
	Herbert Hunniston,	labor,	23 25	
	R. Cotchefer,	expenses and services,	88 25	
				157 22
Feb.	M. Brewster & Co.,	coal,	$11 00	
	"	"	11 00	
	F. C. Hunniston,	labor,	7 50	
	"	"	54 25	
	F. & C. Crittenden & Co.,	fish food,	21 85	
	R. Cotchefer,	expenses and services,	96 56	
				202 16
Mch.	R. R. Flynn & Co.,	salt, etc.,	$4 30	
	M. Bowes & Co.,	coal,	11 00	
	Frederick C. Hunniston,	labor,	57 75	
	Herbert Hunniston,	"	24 75	
	W. D. Oviatt,	"	72 00	
	S. W. Dixon,	cartage,	12 00	
	F. & C. Crittenden & Co.,	fish food,	38 88	
	R. Cotchefer,	expenses and services,	106 76	
	Gould & Knowlten,	plumbing,	62 91	
	Scheeler & Sons,	wire cloth,	8 50	
	A. Beekman,	lumber,	20 68	
	Robert J. Aull,	labor and expenses,	45 02	
	O. S. Johnson,	labor,	12 00	
	Grant Christie,	"	71 50	
	J. M. Mattison,	fish cans,	22 80	
				570 85
April	Grant Christie,	labor and expenses,	$64 55	
	Frederick C. Hunniston,	labor at hatchery,	52 50	
	Herbert Hunniston,	" "	22 50	
	W. D. Oviatt,	labor,	67 50	
		Forward,	$207 05	$2,232 04

1897.		Brought forward,	$207 05	$2,232 04
April	F. & C. Crittenden & Co.,	fish food,	48 65	
	R. Cotchefer,	expenses and services,	104 50	
				360 20
May	W. D. Oviatt,	labor at hatchery,	$11 25	
	R. R. Flynn & Co.,	merchandise,	6 25	
	Frederick C. Hunniston,	labor at hatchery,	54 25	
	Herbert Hunniston,	" "	31 00	
	S. W. Dixon,	labor and cartage,	12 00	
	Grant Christie,	labor and expenses,	56 25	
	F. & C. Crittenden & Co.,	fish food,	40 28	
	R. Cotchefer,	expenses and services,	108 70	
				319 98
June	R. R. Flynn & Co.,	salt,	$8 00	
	O. S. Johnson,	labor,	40 50	
	Herbert Hunniston,	"	30 00	
	Frederick C. Hunniston,	"	52 50	
	F. & C. Crittenden & Co.,	fish food,	53 81	
	R. Cotchefer,	expenses and services,	109 07	
	Charles Fry,	night watchman,	26 25	
				320 13
July	R. R. Flynn & Co.,	salt,	$16 00	
	Brownell & Co.,	hardware,	14 94	
	Frederick C. Hunniston,	labor,	54 25	
	Herbert Hunniston,	"	31 00	
	O. S. Johnson,	"	40 50	
	F. & C. Crittenden & Co.,	fish food,	53 65	
	Kirkham & Platt,	lumber, etc.,	25 56	
	R. Cotchefer,	expenses and services,	210 10	
				346 00
	Total Pleasant Valley,			$3,578 35

Sacandaga Hatchery:

1896.				
Oct.	Burnham & Lowery,	grain and supplies,	$5 71	
	John F. Boyce,	boat supplies,	5 75	
	Edson Osgood,	labor as guide,	3 00	
	George H. Fister,	labor and expenses,	62 00	
	E. F. Boehm,	salary and expenses,	98 40	
				$174 86
Nov.	American Net and Twine Co.,	seines, etc.,	$25 97	
	F. & C. Crittenden & Co.,	liver,	6 16	
	" "	"	1 53	
	James McCormick,	board,	4 00	
	Lewis Wilbur,	labor,	15 00	
		Forward,	$52 66	$174 86

1896.		Brought forward,	$52 66	$174 86
Nov.	Addison McIntyre,	labor,	19 50	
	Edson Osgood,	"	46 50	
	Arthur Boehm,	team and labor,	66 50	
	E. F. Boehm,	salary and expenses,	107 47	
				292 63
Dec.	John F. Boyce,	repairs,	$2 00	
	M. Flynn,	board and labor,	49 15	
	Frederick Boehm,	labor and team,	16 00	
	Edson Osgood,	labor,	9 00	
	George H. Fister,	"	122 00	
	E. F. Boehm,	salary and expenses,	120 74	
				318 89
1897.				
Jan.	F. & C. Crittenden & Co.,	liver,	$4 71	
	" "	"	3 00	
	George H. Fister,	labor,	62 00	
	E. F. Boehm,	salary and expenses,	110 80	
				180 51
Feb.	F. & C. Crittenden & Co.,	liver,	$2 63	
	George H. Fister,	labor,	62 00	
	E. F. Boehm,	salary and expenses,	102 60	
				167 23
Mch.	George H. Fister,	labor,	$48 00	
	E. F. Boehm,	salary and expenses,	91 80	
				139 80
April	John F. Boyce,	repairs,	$4 50	
	George H. Fister,	labor,	62 00	
	E. F. Boehm,	salary and expenses,	94 35	
				160 85
May	F. & C. Crittenden & Co.,	liver,	$5 64	
	George H. Fister,	labor,	60 00	
	E. F. Boehm,	salary and expenses,	91 80	
				157 44
June	F. & C. Crittenden & Co.,	liver,	$4 77	
	Arthur Boehm,	team labor,	13 75	
	George H. Fister,	labor,	62 00	
	E. F. Boehm,	salary and expenses,	94 20	
				174 72
July	Ostrander & Coffin,	supplies,	$25 85	
	John F. Boyce,	blacksmith work,	6 35	
	Albert Danforth,	labor,	22 75	
	Louis Wilbur,	"	22 75	
	Arthur Boehm,	"	14 00	
	Addison McIntyre,	"	24 50	
	George H. Fister,	"	60 00	
	E. F. Boehm,	salary and expenses,	95 65	
				271 85
			Forward,	$2,038 78

1897.			Brought forward,	$2,038 78
Aug.	F. & C. Crittenden & Co.,	liver,	$4 59	
	" "	"	9 25	
	Byron Page,	horse,	50 00	
	Burnham S. Lowery,	oats,	13 17	
	George H. Fister,	labor,	62 00	
	E. F. Boehm,	salary and expenses,	100 45	
	Charles Kellogg Sons Co.,	lumber,	190 50	
				429 96
Sept.	Equitable Gas & Electric Co.,	tar,	$2 50	
	J. M. Masterson,	tin work,	8 92	
	American Net & Twine Co.,	gill net,	17 96	
	" "	cedar corks,	2 55	
	Ostrander & Coffin,	hardware,	26 25	
	Burnham & Lavery,	supplies,	7 06	
	Asa Bird,	lumber,	11 01	
	John F. Bryce,	blacksmith work,	20 88	
	Henry B. Stock,	labor,	29 25	
	William Ball,	"	106 03	
	George H. Fister,	"	62 00	
	E. F. Boehm,	salary and expenses,	113 36	
	Charles Miller & Son,	iron pipe, etc.,	63 53	
				471 30
	Total Sacandaga,			$2,940 04

1897.	James Annin, Jr., Superintendent of Hatcheries:		
Sept.	One year's salary as Superintendent,	$2,500 00	
	Traveling expenses,	431 78	
	Total,		$2.931 78

Expenses incurred hatching whitefish, wall-eyed pike, ciscoes and Oswego bass at Clayton, N. Y.:

1896.				
Oct.	M. B. Hill,	labor and expenses,	$77 20	
	Frederick Hamilton,	fish food,	3 36	
	M. C. Butts,	"	2 00	
	L. M. Crumb,	"	1 56	
	Charles Classen,	"	1 40	
				$85 52
Nov.	M. B. Hill,	salary, labor and expenses,	$167 75	
	William A. Hill,	labor,	3 00	
	Norman B. Hill,	labor, cartage, etc.,	14 00	
	Melvin Stage,	cartage, ice,	5 25	
	W. D. Marks, Stony Island,	labor and expenses,	36 85	
	Ed. Fraser,	labor, seining,	36 00	
	Strough & Brooks,	turpentine, nails, etc.,	6 13	
		Forward,	$268 98	$85 52

1896.		Brought forward,	$268 98	$85 52
Nov.	Maher & Fitzgerald,	coal and delivery, ...	13 20	
	American Net and Twine Co.,	ropes, lead, etc., . . .	30 81	
	J. G. Miller,	labor and expenses, . .	15 30	
				328 29
Dec.	M. B. Hill,	labor and expenses, . .	$106 50	
	Norman Hill,	" " . . .	45 00	
	Byron Mount,	sailboat, ...	7 00	
	Augustus King,	14 gill nets, ...	10 00	
	J. G. Miller,	livery, ...	16 00	
	George C. Putnam,	use of boat, board of men, .	25 00	
	James H. Hanes,	sailboat, 3 trips, . . .	12 00	
	"	labor, 3 gallons whitefish eggs,	12 00	
	John Failing,	ciscoe eggs, ...	28 75	
	Orr Stratton,	"	7 75	
	Schuyler Collins,	"	41 00	
	William Graves,	"	24 50	
	Edward Frasier,	"	9 00	
				344 50
1897.				
Jan.	M. B. Hill,	salary and expenses, . .	$79 00	
	Norman B. Hill,	labor, ...	46 50	
	W. E. Hall,	board of men, etc., . . .	25 25	
	Lester Nugent,	whitefish eggs, . . .	6 00	
	William M. Johnson,	ciscoe eggs, ...	4 00	
	J. H. Hungerford,	25 feet hose, ...	3 00	
	Maher & Fitzgerald,	coal, ...	11 48	
	Strough & Brooks,	basswood timber, . . .	1 04	
	Louis Canell,	2 trips to hatchery, . . .	3 00	
				179 27
Feb.	M. B. Hill,	salary, ...	$77 50	
	Norman B. Hill,	labor, ...	46 50	
				124 00
Mar.	M. B. Hill,	labor, ...	$70 00	
	Norman B. Hill,	"	42 00	
	Maher & Fitzgerald,	coal, ...	9 03	
	J. M. Hungerford,	hardware, ...	12 65	
	J. G. Miller,	cartage, etc., ...	14 00	
				147 68
April	M. B. Hill,	labor, ...	$77 50	
	Norman B. Hill,	"	46 50	
	J. G. Miller,	trips with fish, . . .	47 00	
	John A. Upton,	expenses with car, . . .	46 56	
	Sylvester Selleck,	" . . .	24 65	
	John F. Colon,	trips with fish, . . .	10 50	
	L. J. Giltz,	"	6 00	
	John Ball,	"	9 00	
				267 71
			Forward,	$1,476 97

1897.			Brought forward,		$1,476 97
May	Norman B. Hill,	labor,		$38 25	
	J. M. Hungerford,	tinsmith,		7 50	
					45 75
June	M. B. Hill,	labor,		$57 50	
	Norman B. Hill,	"		15 00	
					72 50
July	M. B. Hill,	labor,		$75 00	
	W. D. Hill,	catching bass,		8 25	
	Norman B. Hill,	"		8 25	
	John Colon,	carting fish,		6 00	
	Grant Christie,	messenger with fish,		40 75	
					138 25
Aug.	M. B. Hill,	labor,		$77 50	
	W. D. Hill,	"		11 25	
	N. B. Hill,	"		5 25	
	Grant Cristie,	labor and expenses,		71 99	
	John A. Upton,	" "		37 87	
	Louis Canell,	delivering telegram and labor,		3 00	
	J. F. Colon,	carting,		12 00	
	W. W. Stage,	ice and carting,		11 00	
	Eli Butts,	liver,		6 30	
					236 16
	Total Clayton,				$1,969 63

Expenses incurred collecting eggs and hatching shad at Catskill hatching station:

1896.				
June	W. D. Oviatt,	labor and expenses,	$94 33	
	John A. Upton,	" "	67 92	
	J. Mason,	" "	42 30	
	William Ball,	" "	32 77	
	O. V. Rogers,	" "	58 77	
	A. E. Cooper,	" "	65 72	
	E. Hallenbeck,	" "	44 00	
	A. Hart,	" "	44 00	
	Capt. John J. Pindar,	fishing seine with crew,	190 00	
	W. Kortz,	bedding, etc.,	17 64	
	Day & Holt,	hardware, etc.,	32 12	
	Vernon E. Ford,	groceries,	23 34	
	L. S. Hart,	board of men,	29 00	
	E. Lampman & Son,	lumber,	69 10	
	Catskill & Hudson Steam Ferry Co.,	transportation,	6 10	
				$817 11
July	W. D. Oviatt,	labor and expenses,	$60 08	
	J. Mason,	" "	34 21	
		Forward,	$94 29	$817 11

1896.		Brought forward,	$94 29	$817 11
July	E. H. Hallenbeck,	labor,	37 00	
	A. H. Hart,	"	32 00	
	John J. Pindar,	fishing seine with crew,	160 00	
	Vernon E. Ford,	groceries,	17 00	
	Catskill & Hudson Steam Ferry Co.,	transportation,	5 70	
	Catskill Water Works,	water rent,	75 00	
				420 99
	Total Catskill,			$1,238 10

Expenses incurred collecting eggs and hatching mascalonge at Chautauqua hatching station:

1896.				
Oct.	Randall R. Brown,	labor and expenses,	$19 50	
	C. C. Wildman & Co.,	lumber,	28 31	
	Grant E. Winchester,	labor,	12 00	
	Norton Bros.,	hardware,	3 78	
	B. Look & Son,	shingles,	5 06	
				$68 65
1897.				
May	Randall R. Brown,	labor and expenses,	$182 46	
	William Ball,	" "	36 49	
	Grant E. Winchester,	" "	50 00	
	E. Monroe Arnold,	" "	38 00	
	Jack Wilcox,	" "	3 00	
	Wayn Brown,	" "	59 75	
	Elmer Brown,	" "	14 00	
	James Seymour,	hardware,	18 01	
	R. D. Brown,	for spiles,	8 00	
	C. C. Wildman & Co.,	lumber,	15 53	
				425 24
June	Randall R. Brown,	labor and expenses,	$76 86	
	John A. Upton,	" "	12 35	
	Wayne Brown,	" "	54 00	
	E. Monroe Arnold,	" "	53 80	
	Elmer Brown,	" "	30 00	
	Grant E. Winchester,	" "	78 50	
	A. J. Pickard,	board of carpenter,	9 00	
	Jotham Bemus,	rent of hatchery,	13 00	
	C. Frank Hall,	labor and expenses,	9 15	
				336 66
	Total Chautauqua,			$830 55

Expenses incurred gathering eggs and hatching pike at Constantia hatching station:

1897.				
May	M. B. Hill, foreman,	labor and expenses, . .	$82 95	
	Jonathan Mason,	" "	54 56	
	Arthur Brown,	lifting nets, ...	10 00	
	George Scriba,	"	24 00	
	C. E. Hess,	"	12 00	
	Dannie C. King,	labor and expenses, . .	106 05	
	James Andrews,	lifting nets, ...	22 00	
	George Lord,	"	20 00	
	Charles Penoyer,	"	20 00	
	Charles Hollady,	"	12 00	
	William Dobson,	" and teams, . .	24 00	
	Daniel Sweet,	" " . .	8 00	
	Charles Whipple,	" " . .	10 00	
	Benjamin Phillips,	" " . .	14 00	
	Henry Marcellus,	" " . .	4 00	
	Edward Miles,	" " . .	10 50	
	Julian P. Carter,	" " . .	14 00	
	Charles Marcellus,	watchman, ...	50 00	
	Earl Thurston,	hatchery assistant, . . .	21 25	
	Leonard Gardiner,	lifting nets and team, . .	17 00	
	William Youngs,	"	8 00	
	H. F. York,	"	12 00	
	John W. Carter,	"	14 00	
	American Net and Twine Co.,	flat nets, etc., ...	3 70	
	Sanford Woodward,	cartman, ...	5 25	
	D. K. Winn,	tinsmith, ...	3 40	
	F. S. Beede,	hardware, ...	1 67	
	A. L. Southwell & Son,	rent of hatchery, ...	50 00	
				$634 33
June	M. B. Hill,	labor and expenses, . .	$21 75	
	Jonathan Mason,	" "	15 75	
	John A. Upton,	" "	51 44	
	J. G. Miller,	" "	18 25	
	Earl Thurston,	" "	18 25	
	D. C. King,	" "	39 60	
	Charles Marcellus,	night watchman, ...	22 00	
	Charles Penoyer,	loading car, ...	2 00	
	Grant Christie,	labor and expenses, . .	49 60	
	Nelson Van Antwerp,	" "	6 25	
	J. D. Black,	hardware, ...	17 87	
	George F. Scriba,	labor and ice, ...	14 20	
		Forward,	$276 96	$634 33

1897.		Brought forward,	$276 96	$634 33
June	Sanford Woodward,	carting ice and cans, . .	13 50	
	A. L. Southwell & Son,	lumber, ...	13 62	
	A. A. Beardsley,	net fixtures, etc., ...	10 62	
				314 70
Aug.	Jonathan Mason,	V. 1, services, ...	$2 00	
	Nelson Van Antwerp,	2, "	1 00	
	Charles Whipple,	3, "	1 00	
	Frank McCann,	4, "	4 00	
	Sanford Woodward,	5, "	1 00	
	Bird Johnson,	6, "	1 00	
	Charles Martin,	7, "	1 00	
	H. W. Mason,	8, "	4 00	
	Earl Thurston,	9, "	1 00	
				16 00
	Total Constantia,	. . . .		$965 03

Expenses incurred collecting and hatching whitefish at Canandaigua lake:

1896.				
Dec.	R. R. Brown,	labor and expenses, . .	$65 74	
	"	" "	95 50	
	Wayne Brown,	" "	81 98	
	W. D. Marks,	" "	70 00	
	William Geiger,	" "	10 00	
	W. D. Oviatt,	" "	15 70	
	G. E. Winchester,	" "	12 73	
	Mrs. C. Beeman,	board of fishermen, . . .	63 91	
				$415 56
1897.				
Jan.	R. R. Brown,	labor and expenses, . .	$113 72	
	Wayne Brown,	" "	54 14	
	W. D. Marks,	" "	38 00	
	W. D. Oviatt,	" "	46 00	
	G. E. Winchester,	" "	57 04	
	William H. Fox,	rent of boat, ...	7 00	
	James Field Co.,	oars and locks, ...	3 22	
	Mrs. C. Beeman,	board of five men, . . .	63 30	
				382 42
	Total Canandaigua,	. . . .		$797 98

Expenses incurred collecting whitefish and salmon trout eggs on Lake Michigan:

1896.				
Nov.	Jonathan Mason,	labor and expenses,	$35 95	
	John A. Upton,	" "	31 70	
	S. M. Rose,	" "	27 00	
				$94 65
Dec.	Jonathan Mason,	labor and expenses,	$87 15	
	Thomas Rudeck,	use of tug,	8 25	
	Albert Fairchild,	"	10 25	
	William H. Chambers,	board of men,	45 19	
	John A. Upton,	labor and expenses,	87 24	
	G. C. Geiken,	use of tug,	50 00	
	Joseph Plant,	labor and expenses,	63 67	
	Ole Olson,	labor, notary fees,	16 25	
				368 00
1897.				
Jan.	Jonathan Mason,	labor and expenses,	$60 27	
	S. M. Rose,	" "	106 76	
	"	" "	66 50	
	Frank Sherman,	" "	25 75	
	"	" "	30 65	
	William H. Chambers,	board of men,	13 50	
	Ole Olson,	taking spawn,	12 25	
	Thomas Rudeck,	use of tug,	5 25	
	Albert Fairchild,	"	3 25	
	Joseph Plant,	labor and expenses,	18 66	
	Cole H. Campbell,	" "	95 15	
	John A. Upton,	" "	107 41	
	Andrew Smith,	board of man,	6 45	
				551 85
	Total Lake Michigan,			$1,014 50

Expenses incurred removing fish from Erie canal near Montezuma and placing same in Seneca river.:

1896.				
Dec.	F. Helmer,	labor, 5 days, at $2.00 per day,	$10 00	
	William Prosser,	" 7 " " "	14 00	
	Dell Helmer,	" 7 " " "	14 00	
	William Prosser, Jr.,	" 2 " " "	2 00	
	Jacob Frantz,	use of seine, etc.,	3 00	
	M. B. Rude,	labor, 5 days, at $1.50 per day,	7 50	
	John A. Rockfeller,	" 2 " with team,	4 00	
	J. M. Bennett,	" 3 " horse and wagon,	6 50	
				$61 00

Transportation of fish car of foreign roads:

1896.			
Nov. 6.	Delaware & Hudson R.R. Co., transportation of car "Adirondack" from Bellows Falls, Vt., to Newbury, N. H., and return,	$37 68	
1897.			
May 31.	Pennsylvania R.R. Co., transportation of fish car "Adirondack" from Jersey City to Havre De Grace and return,	99 60	
			$137 28

Expenses of Superintendent's office at Caledonia, N. Y.:

1896.			
Oct.	J. M. Skinner, stenographer,	$24 00	
	F. W. Blakeslee, clerical work,	15 50	
			$39 50
Nov.	J. M. Skinner, stenographer,	$32 00	
	F. W. Blakeslee, clerical work,	14 00	
	Postage and box rent,	5 25	
	Telegraph and telephone account,	8 31	
	Freight and express,	75	
	Notary fees,	2 00	
	Cleaning office,	35	
			62 66
Dec.	J. M. Skinner, stenographer,	$32 00	
	F. W. Blakeslee, clerical work,	22 00	
	Postage account,	6 00	
	Telegraph account,	8 48	
	Freight and express,	2 40	
	Notary fees,	2 00	
	Stationery and supplies,	3 75	
	Sherman F. Denton, mounting fish,	50 00	
			126 63
1897.			
Jan.	J. M. Skinner, stenographer,	$40 00	
	F. W. Blakeslee, clerical work,	22 00	
	Postage account,	5 09	
	Telegraph and telephone,	8 35	
	Freight and express,	90	
	Notary fees,	2 00	
	Stationery and office supplies,	3 77	
	A. K. Fowler, alcohol,	7 70	
	Eight yards cheese cloth at 5c.,	40	
	Lamp chimneys,	16	
			90 37
		Forward,	$319 16

1897.		Forward,	$319 16
Feb.	J. M. Skinner, stenographer,	$32 00	
	F. W. Blakeslee, office work,	37 50	
	Postage account,	13 55	
	Telegraph and telephone,	4 22	
	Express,	35	
	Notary fees,	1 00	
	Sherman F. Denton, mounting fish,	35 00	
	Gorton & McCabe, table,	7 50	
	A. H. Collins, printing,	2 35	
	Stationery and office supplies,	7 85	
	Messenger to Rochester and return,	1 20	
	"Railroad Guide," 1 year,	2 00	
			144 52
Mch	J. M. Skinner, stenographer,	$32 00	
	F. W. Blakeslee, clerical work,	16 00	
	H. L. Carpenter, photo. work,	10 25	
	A. H. Collins, printing,	1 75	
	Postage account,	6 00	
	Telegraph and telephone,	6 58	
	Notary fees,	1 00	
	Stationery,	1 10	
			74 68
April	J. M. Skinner, stenographer,	$44 00	
	F. W. Blakeslee, clerical work,	24 50	
	Postage account,	15 08	
	Telegraph and telephone,	5 72	
	Notary fees,	1 00	
	Stationery,	1 55	
	Net photographs,	90	
	A. H. Collins, printing,	3 50	
	S. F. Denton, mounting specimens,	25 00	
			121 25
May	J. M. Skinner, stenographer,	$32 00	
	F. W. Blakeslee, clerical work,	21 00	
	A. H. Collins, printing,	3 00	
	Postage account,	10 25	
	Telegraph account,	8 80	
	Express account,	25	
	Stationery,	1 70	
			77 00
June	J. M. Skinner, stenographer,	$32 00	
	F. W. Blakeslee, clerical work,	33 50	
	Postage account,	12 00	
	Forward,	$ 77 50	$736 61

1897.	Brought forward,	$77 50	$736 61
June	Telegraph and telephone,	22 29	
	Express and freight,	1 50	
	Stationery and office supplies,	9 70	
	Shakes and rollers,	3 00	
			113 99
July	J. M. Skinner, stenographer,	$40 00	
	F. W. Blakeslee, clerical work,	12 00	
	Postage account,	5 06	
	Telegraph and telephone account,	11 72	
	Freight and express,	3 35	
	Stationery,	1 65	
	A. H. Collins, printing,	4 25	
			78 03
Aug.	J. M. Skinner, stenographer,	$32 00	
	F. W. Blakeslee, clerical work,	11 00	
	Wm. Crater, attorney McKay case,	10 00	
	" " " " expenses,	4 18	
	Postage account,	7 25	
	Telegraph and telephone account,	14 34	
			78 77
Sept.	J. M. Skinner, stenographer,	$32 00	
	F. W. Blakeslee, clerical work,	13 50	
	Postage account,	10 00	
	Telegraph and telephone,	5 55	
	A. H. Collins, cards,	1 00	
	Stationery and office supplies,	1 65	
			63 70
	Total expenses, Superintendent's office,		$1,071 10

Insurance on hatcheries:

1896.		
Sept.	Milton Carter, insurance on hatcheries,	$72 00

Total Hatcheries Account,	$53,394 64

Schedule "B."

SUMMARY OF SALARIES AND EXPENSES PAID FISH, GAME AND OYSTER PROTECTORS FOR FISCAL YEAR ENDING SEPTEMBER 30, 1897.

	Salaries.	Expenses.	Total.
J. W. Pond, Chief Protector,	$2,000 00	$913 91	$2,913 91
William Wolf, Clerk to Chief Protector,	1,300 00	13 00	1,313 00
John E. Leavitt, Assistant Chief,	1,200 00	645 09	1,845 09
M. C. Worts, "	1,200 00	752 22	1,952 22
M. C. Finley, Special Agent,	1,000 00	243 23	1,243 23
Edgar Hicks, Oyster Protector,	1,000 00	673 78	1,673 78
Sebastian Hesbach, "	350 00	111 14	461 14
Selah T. Clock, "	995 89	279 32	1,275 21
John Ferguson, Assistant Oyster Protector,	567 50	276 59	844 09
John L. Ackley, Protector,	458 33	450 00	908 33
Fletcher S. Beede, "	500 00	469 00	969 00
Edw. I. Brooks, "	500 00	450 00	950 00
George Carver, "	500 00	450 06	950 06
Thomas H. Donnelly, "	499 92	450 36	950 28
Lester S. Emmons, "	500 00	449 95	949 95
Ira Elmendorf, "	262 14	237 40	499 54
Eugene Hathway, "	428 08	318 56	746 64
Spencer Hawn, "	500 00	444 81	944 81
James Holmes, "	500 00	417 93	917 93
Carlos Hutchins, "	500 00	450 00	950 00
E. A. Hazen, "	500 00	390 12	890 12
Robert S. Jones, "	193 01	166 11	359 12
Willett Kidd, "	500 00	458 77	958 77
A. B. Klock, "	145 89	100 82	246 71
J. H. Lamphere, "	500 00	450 00	950 00
J. W. Littlejohn, "	500 00	464 45	964 45
J. D. Lawrence, "	423 31	397 10	820 41
E. J. Lobdell, "	500 00	450 00	950 00
B. H. McCollum, "	479 17	441 39	920 56
Joseph Northup, "	500 00	454 18	954 18
F. M. Potter, "	500 00	354 20	854 20
D. N. Pomeroy, "	411 96	388 02	799 98
W. L. Reed, "	500 00	450 00	950 00
R. M. Rush, "	500 00	429 15	929 15
Bernard Salisbury, "	500 00	442 87	942 87
Nicholas Shaul, "	395 85	412 50	808 35
George B. Smith, "	500 00	450 00	950 00
Alvin Winslow, "	499 98	397 14	897 12
Albert Warren, "	447 48	400 66	848 14
Forward,	$23,258 51	$15,993 83	$39,252 34

		Salaries.	Expenses.	Total.
	Brought forward,	$23,258 51	$15,993 83	$39,252 34
H. L. Wait,	Protector,	354 11	294 89	649 00
A. A. Wyckoff,	"	354 16	312 02	666 18
William Cookingham,	"	104 15	39 21	143 36
F. M. Potter,	"	41 74	18 61	60 35
O. S. Potter,	"	13 89	6 20	20 09
James F. Shedden,	"	402 71	361 30	764 01
James H. O'Brien,	"	5 37	8 50	13 87
Moses E. Sawyer,	"		44 72	44 72
Stanton J. Tefft,	"	157 23	126 47	283 70
Uriah Satterlee,	"		7 70	7 70
Total,		$24,691 87	$17,213 45	$41,905 32

Schedule "C."

Official Salaries and Expenses.

	Salaries.	Expenses.	Total.
Barnet H. Davis, President,	$3,000 00	$800 00	$3,800 00
William R. Weed, Commissioner,	2,500 00	800 00	3,300 00
Charles H. Babcock, "	2,708 34	866 66	3,575 00
Edward Thompson, "	2,708 34	866 66	3,575 00
Hendrick S. Holden, "	2,708 34	866 66	3,575 00
A. N. Cheney, State Fish Culturist,	3,000 00	544 91	3,544 91
William F. Fox, Engineer,	2,238 38	89 79	2,328 17
Total,	$18,863 40	$4,834 68	$23,698 08

Schedule "D."

Salaries and Expenses.—Clerical Force.

Charles A. Taylor, Assistant Secretary,	$2,000 00	
A. J. Mulligan, Auditor,	1,600 00	
A. B. Strough, Special Agent,	1,283 34	
J. J. Fourqurean, Stenographer,	1,200 00	
Total,		$6,083 34

Schedule "E."

Expenditures on Account of Shellfish Office.

Edward Thompson, rent and office expenses,	$1,027 66	
F. B. Mitchell, salary and expenses,	1,050 00	
Charles Wyeth, salary and expenses,	764 95	
Edgar Hicks, expenses of naphtha launch,	214 42	
Gas Engine and Power Co., launch fixtures,	182 80	
Brandow Printing Co., printing,	117 67	
Weed Parsons Printing Co., printing,	104 75	
C. A. Taylor, postage,	40 00	
" blank books,	5 00	
H. Adams, lumber for signals,	6 44	
"Staten Islander," advertising,	21 00	
"The Sentinel," "	19 00	
"The Staten Island Gazette," advertising,	19 00	
C. E. Griffith, insurance,	15 00	
Hyde & Co., maps,	38 00	
Total,		$3,625 69

Schedule "F."

Office Expenses.

Stationery and printing:		
Weed Parsons Printing Co.,	$415 56	
Brandow Printing Co.,	1,074 81	
Hudson Valley Paper Co.,	96 32	
S. G. Speir,	29 00	
H. W. Riggs,	16 75	
R. B. Hough,	8 50	
A. H. Clapp,	46 96	
Albany News Company,	32 65	
D. S. Walton & Co.,	18 00	
W. H. Sample,	10 00	
W. K. Sanders,	6 75	
		$1,755 30
Telephone and telegraph:		
Western Union Telegraph Co.,	$332 54	
Postal Cable Telegraph Co.,	22 53	
Hudson River Telephone Co.,	246 68	
		601 75
Forward,		$2,357 05

Brought forward,		$2,357 05
Postage and express:		
American Express Co.,	$394 20	
National Express Co.,	105 00	
Postage account,	618 50	
		1,117 70
Miscellaneous expenses:		
George H. West, special agent, salary 2 months,	$200 00	
" " expenses,	31 49	
Smith Premier Co., typewriter,	60 00	
Albany Hardware Co., sundries,	14 00	
A. L. Curtis, file cases,	8 50	
A. M. Michaels, net tags,	18 35	
Lang Stamp Works, rubber stamps,	29 95	
F. H. Woods, P. O. Box rent,	4 31	
J. B. Lyon, binding,	3 00	
J. M. McDonough, books,	29 60	
J. J. Jones, stamps,	6 50	
George H. Rison, photograph work,	25 75	
The Argos Co., subscription,	7 50	
"Garden and Forest," subscription,	4 00	
"Forest and Stream," "	4 00	
Sampson Murdock & Co., (two directories)	6 00	
Houghton, Mifflin & Co., books,	1 25	
J. C. McClosky, books,	16 20	
Banks Bros., "	7 00	
Great Bear Spring Co., water,	1 75	
K. E. McCollum, photo. work,	6 00	
William F. Fox, mounting deer heads,	24 25	
Nightingale & Johnson, electric lamps,	15 78	
J. J. Fourqurean, notary certificate,	5 00	
Office and Library Co., file cases,	8 00	
		538 18
Total office expenses,		$4,012 93

Forest Preserve Account.

FISCAL YEAR ENDING SEPTEMBER 30, 1897.

Balance October 1, 1896,	$5,739 99	
		$5,739 99
DISBURSEMENTS.		
William F. Fox, Engineer, balance salary,	$41 66	
" " travelling expenses,	858 56	
George H. West, Special Agent, travelling expenses,	528 53	
" " salary,	770 00	
A. B. Strough, " travelling expenses,	336 27	
F. R. Smith, Custodian Lake George Islands, salary,	187 08	
Blue Mountain Lake Steamboat Co., use of steamer,	45 00	
C. A. Reynolds, map,	10 00	
Charles A. Taylor, travelling expenses,	46 41	
Reuben Lawrence, taxes, John Brown homestead,	13 17	
Eugene Thew, shingles, " "	33 00	
		$2,869 68
Balance September 30, 1897,		2,870 31
		$5,739 99

Miscellaneous Accounts.

ACQUIRING LAND AND WATER RIGHTS AT CALEDONIA HATCHERY.

Appropriation, chapter 86, Laws of 1896,		$5,000 00	
			$5,000 00
1897.	**DISBURSEMENTS.**		
Jan. 9	R. L. Seldon & Son., for survey, computation, description and map of the McKay Mill pond and vicinity, Caledonia, N. Y.,	$20 00	
			$20 00
Balance September 30, 1897,			4,980 00
			$5,000 00

CLAIMS ARISING UNDER FORMER COMMISSIONS.

Balance October 1, 1896,		$2,193 17	
			$2,193 17
1896.	**DISBURSEMENTS.**		
Dec. 10	J. W. Chrispell, President of Alder Lake Club, for fish fry,	$350 00	
1897.			
Feb. 13	I. B. Lyon, printing,	185 00	
Mch. 26	S. C. Armstrong, travelling expenses,	200 00	
June 8	E. G. Whitaker, legal services,	200 00	
July 8	Cantwell & Contwell, legal services,	500 00	
			$1,435 00
Balance September 30, 1897,			758 17
			$2,193 17

Completion and Equipment of Ponds at Pleasant Valley Hatchery.

Balance, October 1, 1896,		$154 93	
			$154 93

1896.		Disbursements.		
Oct.	12	Gould & Nowlen, for pipe valves, wire netting, packing and labor on hatchery,	$154 70	
				$154 70
Balance September 30, 1897,				23
				$154 93

Extermination of Billfish in Black Lake.

Balance October 1, 1896,		$245 52	
			$245 52

1896.			Disbursements.		
Nov.	19	George Monk,	services netting,	$20 00	
"	19	Frederick Apple,	"	20 00	
1897.					
June	8	George Monk,	"	4 00	
"	8	Frederick Apple,	"	4 00	
Aug.	6	George Monk,	"	25 00	
"	6	Frederick Apple,	"	25 00	
					$98 00
Balance September 30, 1897,					147 52
					$245 52

Extermination of Billfish in Chautauqua Lake.

Balance October 1, 1896,	$759 31	
Appropriation, chapter 790, Laws of 1897,	500 00	
		$1,259 31

1896.		Disbursements.		
Oct.	R. R. Brown,	labor and expenses,	$131 97	
	James L. Brown,	rent of steamboat,	32 50	
	George W. Browne,	boat and labor,	66 50	
	E. Monroe Arnold,	labor,	14 00	
	Grant E. Winchester,	expense and labor,	65 10	
	E. P. Young,	coal and oil,	13 97	
	W. D. Marks,	labor and expenses,	56 22	
	W. M. Dick,	" " with nets,	177 56	
				$557 82
Nov.	George W. Brown,	services finding stolen trap net,	$6 00	
				6 00
			Forward,	$563 82

1896.		Brought forward,		$563 82
July	R. R. Brown,	labor and expenses,	$51 65	
	Grant E. Winchester,	" "	40 00	
	E. Monroe Arnold,	" "	40 00	
	Wayne Brown,	" "	40 00	
	L. Boss,	use of steam yacht,	80 00	
				251 65
Aug.	R. R. Brown,	labor and expenses,	$39 83	
	Grant E. Winchester,	" "	24 00	
	E. M. Arnold,	board and labor,	28 50	
	James G. Smith	bbl. coal tar,	5 50	
	Wayne Brown,	labor,	28 00	
	L. Boos,	use of steam yacht,	40 00	
				165 83
Sept.	American Net and Twine Co.,	2 pound nets and connections,		150 52
				$1,131 82
Balance September 30, 1897,				127 49
				$1,259 31

St. Lawrence Reservation.

Appropriation, chapter 273, Laws of 1897, for the purpose of acquiring lands in "The State Reservation on the Saint Lawrence River" and improving and maintaining said lands,	$30,000 00	
		$30,000 00

Disbursements.

"Republican and Journal,"	advertising for lands,	$11 00	
Standard Publishing Co.,	" "	25 00	
Broackway Publishing Co.,	" "	25 00	
Thousand Island Publishing Co.,	" "	6 00	
L. C. Sutton,	" "	3 00	
George F. Darrow,	" "	1 25	
C. B. Wood,	" "	3 00	
Oswego Palladium,	" "	12 48	
"Ogdensburgh News,"	" "	7 00	
Oswego Publishing Co.,	" "	15 03	
Fay & Sons,	" "	3 40	
A. B. Strough,	expenses examining lands offered for sale,	233 03	
A. N. Cheney,	" " " " " "	315 58	
			$660 77
Balance September 30, 1897,			29,339 23
			$30,000 00

Account of Firewardens for Posting Fire Notices and Fighting Forest Fires.

Balance October 1, 1896,	$267 79	
Cash in hands of William R. Weed, Chairman,	28 50	
Appropriation, chapter 790, Laws of 1897,	2,000 00	
		$2,296 29

DISBURSEMENTS.

1897.					
May	Herbert Gifford,	services,	Mayfield,	Fulton Co.,	$1 50
	Nicholas Kent,	"	"	"	1 50
	Melvin Warner,	"	"	"	3 00
	Ralph Bradley,	"	Schroon,	Essex Co.,	8 00
	C. C. Whitney,	"	"	"	4 00
	Robert Warrington,	"	"	"	3 00
	Edward McDowell,	"	Halfmoon,	Saratoga Co.,	5 00
	Loat Tenant,	"	Edinburg,	"	4 00
	D. Fountain,	"	"	"	8 00
	Frederick Cloutier,	"	"	"	2 00
	Henry Michael,	"	"	"	8 00
	Frank Simpson,	"	"	"	4 00
	Leander Simpson,	"	"	"	4 00
	Lewis M. Stockwell,	"	"	"	2 00
	Clarence Carey,	"	"	"	4 00
	H. Bunister,	"	"	"	2 00
	George Mosher,	"	"	"	8 00
	John Labounty,	"	"	"	4 00
	Judson Rhodes,	"	"	"	2 00
	John McCarthy,	"	"	"	2 00
	Cicero McGraw,	"	"	"	2 00
	David Olmstead,	"	"	"	2 00
	Henry Simpson,	"	"	"	2 00
	Newton Tenant,	"	"	"	4 00
	George Tenant,	"	"	"	2 00
	Mike Dillon,	"	"	"	10 00
	George Stockwell,	"	"	"	2 00
	Lewis Tenant,	"	"	"	8 00
	John Tenant,	"	"	"	8 00
	Hiram Loveless,	"	"	"	6 00
	A. Rogers,	"	"	"	10 00
	William Hopkins,	"	"	"	6 00
	Orman Hopkins,	"	"	"	4 00
	Ed. Tenant,	"	"	"	8 00
				Forward,	$154 00

1897.		Brought forward,	$154 00
May	Sylvester Loveless,	services, Edinburg, Saratoga Co., .	10 00
	Alfred Mosher,	" " " .	8 00
	Willie Wells,	" " " .	8 00
	Wian Edmonds,	" " " .	2 00
	James H. Tenant,	" " " .	2 00
	Henry P. Morris,	" " " .	4 00
	George Walker,	" " " .	8 00
	George Robinson,	" " " .	2 00
	Henry Sendamorl,	" " " .	2 00
	C. F. Thomas,	" Clifton, St. Lawrence Co.,	38 00
	M. W. Dean,	" Clare, "	8 00
	George W. Dukelow,	" Horseshoe, "	58 00
	Lawrence Carroll,	" Dresden, Washington Co.,	4 00
	Douglas Morehouse,	" Johnsburg, Warren Co., .	6 00
	E. Spaulding,	" " " .	6 00
	George Morehouse,	" " " .	2 00
	George W. Parker,	" Highland, Sullivan Co., .	14 00
	James Boyd,	" " " .	4 00
	E. B. Wilson,	" " " .	4 00
	Robert Greig,	" " " .	4 00
	George Crandall,	" " " .	4 00
	Charles E. Stanton,	" " " .	4 00
	E. V. Myers,	" " " .	2 00
	W. H. Parker,	" " " .	4 00
	John P. Hulse,	" " " .	4 00
	Webster Lobarr,	" " " .	4 00
	M. B. Eaton,	" " " .	6 00
	Robert Cootes,	" " " .	6 00
	Leon Parker,	" " " .	4 00
	Charles W. Wilson,	" " " .	4 00
	Stephen Warmouth,	" " " .	4 00
	J. C. Muir,	" " " .	2 00
	A. D. Wilmarth,	" " " .	2 00
	James Morgan,	" " " .	4 00
	Robert Crandall,	" " " .	6 00
	A. T. Sargent,	" " " .	6 00
	F. K. Sargent,	" " " .	4 00
	William Horton,	" " " .	4 00
	Truman Leavenworth,	" " " .	4 00
	George Lasalle,	" " " .	4 00
	Emmet Seeley,	" " " .	6 00
	F. J. C. Kyte,	" " " .	4 00
	H. W. Kyte,	" " " .	4 00
	James A. Hulse,	" " " .	4 00
	Isaac Sargent,	" " " .	4 00
		Forward,	$452 00

1897.				Brought forward,	$452 00
May	Garfield Leavenworth,	services,	Highland,	Sullivan Co., .	4 00
	Charles W. Hulse,	"	"	" .	6 00
	Frank Ort,	"	"	" .	8 00
	A. W. Rundle,	"	"	" .	10 00
	D. E. Crandall,	"	"	" .	4 00
	W. H. Parker.	"	"	" .	4 00
	Frank Gloss,	"	"	" .	4 00
	M. O. Sargent,	"	"	" .	4 00
	Atwell Bradley,	"	"	" .	2 00
	C. B. Page,	"	"	" .	8 00
	Edwin Avery,	"	"	" .	2 00
	S. M. Dailey,	"	"	" .	8 00
	Herman S. Dailey,	"	"	" .	10 00
	James Boyd, Jr.,	"	"	" .	4 00
	W. H. Wilson,	"	"	" .	8 00
	Sherman Leavenworth,	"	"	" .	4 00
	Nathan Daley,	"	"	" .	6 00
	John T. Onderdonk,	"	"	" .	4 00
	Mohlan I. Clark,	"	"	" .	6 00
	Richard D. Wait,	"	"	" .	6 00
	J. D. Eldred,	"	"	" .	8 00
	A. S. Myers,	"	"	" .	10 00
	H. H. Kimball,	"	"	" .	10 00
	George L. Sauer,	"	Cochecton,	" .	7 80
	Ferdinand Wehle,	"	"	" .	3 00
	Christopher Rupp,	"	"	" .	6 00
	J. A. Miller,	"	"	" .	2 00
	Louis Faber,	"	"	" .	3 00
	Frederick Theis,	"	"	" .	5 80
	C. B. Farley,	"	"	" .	5 40
	W. H. Lewis,	"	"	" .	5 60
	Emil Keyler,	"	"	" .	6 00
	A. J. Parr,	"	"	" .	4 00
	Jacob Zeires,	"	"	" .	2 80
	William Brunning,	"	"	" .	4 00
	Adam Sauer,	"	"	" .	4 00
	Charles Laburt,	"	"	" .	4 00
	J. W. Bassett,	"	"	" .	5 60
	Paul Hartman,	"	"	" .	9 30
	John Binning,	"	"	" .	2 00
	William Miller,	"	"	" .	4 00
	John Hipe,	"	"	" .	6 00
	A. C. Hipe,	"	"	" .	8 00
	W. J. McNeeley,	"	"	" .	4 00
	Felix Henle,	"	"	" .	2 00
				Forward,	$696 30

1897.				Brought forward,	$696 30
May	John Henle,	services,	Cochecton,	Sullivan Co.,	4 00
	William H. Kirchfer,	"	"	"	3 00
	Adam Hipe,	"	"	"	5 00
	Jacob Henle,	"	"	"	4 00
	Jacob Kinne,	"	"	"	2 00
	George Merkensioger,	"	"	"	3 00
	Howard Kessler,	"	"	"	2 00
	Peter Warmuth,	"	"	"	3 00
	William R. Kessler,	"	"	"	2 00
	Deitrich Voight,	"	"	"	2 00
	Peter Theiss,	"	"	"	12 00
	George Townsend,	"	"	"	2 00
	Charles Hipe,	"	"	"	4 00
	Joseph Cochrane,	"	"	"	2 00
	Chris. Moohn,	"	"	"	1 00
	Henry Messance,	"	"	"	3 00
	August Geison,	"	"	"	4 50
	Rudolph Aplanalp,	"	"	"	3 00
	Frank Cochrane,	"	"	"	2 00
	Charles Krank,	"	"	"	3 00
	Conrad Stroubel,	"	"	"	4 40
	James Lendridge,	"	"	"	4 40
	Charles Strouble,	"	"	"	3 00
	Michael Finnerty,	"	"	"	6 00
	F. A. Bossert,	"	"	"	5 20
	Conrad Bertsch,	"	"	"	5 20
	Charles Theis,	"	"	"	6 00
	George L. Decker,	"	Oakland Valley,	"	22 00
	Asa Ogden,	"	"	"	6 00
	H. E. Brooks,	"	"	"	8 00
	W. A. Case,	"	"	"	4 00
	Leonard Ketchum,	"	"	"	2 00
	John Sulgar,	"	"	"	1 00
	Thomas L. Brooks,	"	"	"	6 00
	Henry E. Decker,	"	"	"	6 00
	E. R. Case,	"	"	"	3 00
	W. L. Warden,	"	"	"	6 00
	Emmet Decker,	"	"	"	4 00
	Benjamin J. Barber,	"	"	"	5 00
	W. W Case,	"	"	"	1 00
	John Decker,	"	"	"	3 00
	C. A. Case,	"	"	"	3 00
	Eugene Decker,	"	"	"	4 00
	J. B. Case,	"	"	"	3 00
	Thomas L. Decker,	"	"	"	4 00
				Forward,	$888 00

1897.				Brought forward,	$888 00
May	Charles Warden,	services,	Oakland Valley,	Sullivan Co.,	4 00
	Levi Gordon,	"	"	"	5 00
	Benjamin F. Decker,	"	"	"	1 00
	Edgar Decker,	"	"	"	9 00
	William Lane,	"	"	"	1 00
	Lewis Boyd,	"	"	"	9 00
	Charles Dinser,	"	Lumberland,	"	2 00
	William H. Knight,	"	"	"	2 00
	William McBride,	"	"	"	2 00
	A. F. McDonough,	"	"	"	6 00
	Jacob Partz,	"	"	"	6 00
	Ira Edwards,	"	"	"	2 00
	Peter Canfield,	"	"	"	4 00
	Calvin Knight,	"	"	"	2 00
	S. W. Edwards,	"	"	"	2 00
	Jesse Knight,	"	"	"	2 00
	Charles Hawkins,	"	"	"	2 00
	J. J. Knight,	"	"	"	2 00
	W. J. Knight,	"	"	"	2 00
	J. Buckingham,	"	"	"	2 00
	N. Parsett,	"	"	"	2 00
	J. G. Parsett,	"	"	"	2 00
	H. M. Edwards,	"	"	"	2 00
	Joseph Carr,	"	"	"	2 00
	J. D. Knight,	"	"	"	2 00
	W. F. Saywell,	"	"	"	2 00
	W. R. Saywell,	"	"	"	2 00
	Louis Webber,	"	"	"	4 00
	Otto Webber,	"	"	"	4 00
	William Webber,	"	"	"	4 00
	George W. Snyder,	"	"	"	2 00
	John Webber,	"	"	"	4 00
	Leonel Picken,	"	"	"	6 00
	Irving Cavert,	"	"	"	4 00
	Abram Canfield,	"	"	"	6 00
	M. P. Smith,	"	"	"	4 00
	S. R. Gillispie,	"	"	"	4 00
	George W. Wilson,	"	"	"	2 00
	Davis McBride,	"	"	"	4 00
	J. L. Smith,	"	"	"	4 00
	August Kalin,	"	"	"	2 00
	William Ruddick,	"	"	"	13 00
	H. O. Hoyt,	"	"	"	2 00
	Timothy Downey,	"	"	"	4 00
	Daniel Sullivan,	"	"	"	6 00
				Forward,	$1,048 00

1897.				Brought forward,	$1,048 00
May	George McDonough,	services,	Lumberland,	Sullivan Co.,	6 00
	Philip Gerhardt,	"	Fremont,	"	35 52
	F. D. Hulse,	"	"	"	4 00
	Theodore Webber,	"	"	"	18 00
	John Gerry,	"	Shandaken,	Ulster Co.,	2 00
	Jacob Whitney,	"	"	"	8 00
	Sherman Depuw,	"	"	"	2 00
	Eli Miller,	"	"	"	4 00
	Ezra P. Hillson,	"	"	"	4 00
	John R. Maben,	"	"	"	2 00
	Norman Rickert,	"	"	"	2 00
	F. A. Brimer,	"	"	"	12 00
	Charles Brimer,	"	"	"	4 00
	Adolph Umkey,	"	"	"	2 00
	Patrick Johnson,	"	"	"	18 00
	Gilbert Brice,	"	"	"	2 00
	James F. Brown,	"	"	"	16 00
	C. W. Williams,	"	"	"	2 00
	George Rider,	"	"	"	4 00
	Jesse Van Valkenburgh,	"	"	"	2 00
	William Lafferty,	"	"	"	2 00
	Alonzo Winne,	"	"	"	6 00
	James Somerville,	"	"	"	16 00
	Cyrus Bramer,	"	"	"	6 00
	Julius Hammond,	"	"	"	8 00
	Ormond Grant,	"	"	"	8 00
	Oscar Culueck,	"	"	"	2 00
	Peter Winne,	"	"	"	2 00
	Romain Vand,	"	"	"	6 00
	Clarence Angle,	"	"	"	2 00
	John E. Rowe,	"	"	"	6 00
	E. Avery,	"	"	"	2 00
	Ephriam Rowe,	"	"	"	4 00
	W. H. Rowe,	"	"	"	4 00
	Frederick Hammond,	"	"	"	8 00
	William Bramer,	"	"	"	6 00
	Matthew Johnson,	"	"	"	2 00
	Herbert Hammond,	"	"	"	6 00
	Alfred Peck,	"	"	"	4 00
	Thomas Burns,	"	"	"	2 00
	E. C. Rowe,	"	"	"	4 00
	Edward Dutcher,	"	"	"	6 00
	George Myers,	"	"	"	6 00
	Thomas Summerville,	"	"	"	6 00
	Vernon Rider,	"	"	"	2 00
				Forward,	$1,323 52

1897.				Brought forward,	$1,323	52
May	Samuel Gunlick,	services,	Shandaken,	Ulster Co.,	6	00
	Urich Gunlick, Jr.,	"	"	"	4	00
	Samuel Fiero,	"	"	"	8	00
	Lewis Fiero,	"	"	"	2	00
	Hiram Miller, Jr.,	"	"	"	4	00
	Alexander Evans,	"	"	"	6	00
	J. D. Cornerright,	"	"	"	4	00
	John Miller,	"	"	"	4	00
	Robert Blythe,	"	"	"	2	00
	Philip Miller,	"	"	"	2	00
	John Hallenbeck.	"	"	"	10	00
	Henry S. Lane,	"	"	"	4	00
	"	"	"	"	2	00
	Joseph Rider,	"	"	"	6	00
	Jesse Ellsworth,	"	"	"	2	00
	I. L. McGrath,	"	"	"	6	00
	George Parker,	"	"	"	2	00
	Edward Platt,	"	"	"	2	00
	Sidney Dutcher,	"	"	"	2	00
	Allan Dutcher,	"	"	"	2	00
	George A. Dutcher,	"	"	"	2	00
	Marvin E. Hubbell,	"	"	"	4	00
	Ferris Joslin,	"	"	"	2	00
	Orison Dutcher,	"	"	"	2	00
	Clarence Haynes,	"	"	"	2	00
	Myron C. Davis,	"	"	"	4	00
	Anthony W. Woolheater,	"	"	"	4	00
	Lewis O. Smith,	"	"	"	4	00
	James H. Parker,	"	"	"	2	00
	James W. Dutcher,	"	"	"	2	00
	Charles Brimer,	"	"	"	2	00
	Burrett McKillip,	"	"	"	2	00
	Edward Duffy,	"	"	"	2	00
	Addison C. Haynes,	"	"	"	2	00
	Daniel Moben,	"	"	"	2	00
	William C. Mabin,	"	"	"	2	00
	Joseph Datti, Jr.,	"	"	"	8	00
	Charles Mabin,	"	"	"	8	00
	Frederick Andrews,	"	"	"	8	00
	Everett Woolheater,	"	"	"	4	00
	John Barnum,	"	"	"	2	00
	George W. Dutcher,	"	"	"	6	00
	Frederick Parker,	"	"	"	2	00
	Nelson Murray,	"	"	"	2	00
	Willie Woolheater,	"	"	"	2	00
				Forward,	$1,485	52

1897.				Brought forward,	$1,485 52
May	Arthur Murray,	services, Shandaken,	Ulster Co.,	.	2 00
	George Murray,	" "	"	.	2 00
	Charles L. Dutcher,	" "	"	.	4 00
	Willis Robinson,	" "	"	.	8 00
	Hector Rosa,	" "	"	.	10 00
	William Brockman,	" "	"	.	2 00
	Eben Chase,	" "	"	.	2 00
	Benson Dutcher,	" "	"	.	2 00
	C. H. Burnham,	" "	"	.	2 00
	Warren Johnson,	" "	"	.	2 00
	Edwin Cole,	" "	"	.	2 00
	Loren Bray,	" "	"	.	2 00
	Asa Joslin,	" "	"	.	2 00
	Edward Dutcher,	" "	"	.	8 00
	N. Rickert,	" "	"	.	8 00
	Millard H. Davis,	" "	"	.	2 00
	Augustus Jones,	" "	"	.	4 00
	George Bramer,	" "	"	.	6 00
	Jacob Dupuy,	" "	"	.	4 00
	Frank Decker,	" "	"	.	6 00
	George Warden,	" "	"	.	2 00
	Orrin Green ($14),	" "	"	.	6 00
	William V. N. Brice,	" "	"	.	2 00
	L. T. Churchville,	" "	"	.	4 00
	Claude Bishop,	" "	"	.	2 00
	Benjamin Churchville,	" "	"	.	4 00
	A. D. Gulich,	" "	"	.	4 00
	John Coddington ($14),	" "	"	.	6 00
	William P. Markell,	" "	"	.	2 00
	George Van Bumble,	" "	"	.	6 00
	D. A. Lane,	" "	"	.	6 00
	Bert Feney,	" "	"	.	2 00
	Hubert Swartout,	" "	"	.	2 00
	Peter Holsinger,	" "	"	.	4 00
	Reuben E. Rosman,	" "	"	.	4 00
	John B. Rider,	" "	"	.	4 00
	E. J. Mead,	" "	"	.	3 00
	Zenis Dunham,	" "	"	.	4 00
	George Garrison,	" "	"	.	3 00
	John E. Ford,	" "	"	.	8 00
	Charles H. Lott,	" "	"	.	3 00
	Caleb Gossoo,	" "	"	.	4 00
	Charles E. Ford,	" "	"	.	8 00
	E. D. Fisher,	" "	"	.	4 00
	Emery Hammell,	" "	"	.	4 00
				Forward,	$1,666 52

1897.				Brought forward,	$1,666 52
May	Lewis J. Bennett,	services,	Shandaken,	Ulster Co.,	4 00
	Barrett Eighmey,	"	"	"	8 00
	Garrett C. Gosso,	"	"	"	4 00
	David Larkin,	"	"	"	8 00
	William S. Larkin,	"	"	"	8 00
	Thomas Lavey,	"	"	"	6 00
	Frederick Roberts,	"	"	"	6 00
	Philip M. Roberts,	"	"	"	6 00
	William Short,	"	"	"	8 00
	George Short,	"	"	"	6 00
	John J. Larkins,	"	"	"	6 00
	Freeman Trowbridge,	"	"	"	6 00
	John R. Evans,	"	"	"	8 00
	Frank Gerry,	"	"	"	8 00
	William Clancey,	"	"	"	6 00
	Merritt Temple,	"	"	"	6 00
	John A. Lord,	"	"	"	5 00
	Frank D. Lord,	"	"	"	2 00
	William D. Lord,	"	"	"	7 00
	Charles Dwyer,	"	"	"	8 00
	A. J. Mulligan, expenses,				8 00
	Edward Hallenbeck, labor, Phœnicia,				6 00
	B. H. Davis,	services,	Schroon,	Essex Co.,	2 00
	Robert Davis,	"	"	"	4 00
	Isaac Schemerhorn,	"	Caldwell,	Warren Co.,	2 00
	William H. Schemerhorn,	"	"	"	2 00
	H. R. Richards,	"	Johnsburg,	"	24 00
	William Mellington,	"	"	"	4 00
	Henry Rist,	"	"	"	2 00
	F. C. Richards,	"	"	"	4 00
	James Barney,	"	"	"	4 00
	Edgar Moxham,	"	"	"	4 00
	Truman Bills,	"	"	"	4 00
	J. A. Balcomb,	"	Hague,	"	5 00
	James May,	"	"	"	9 00
	George Galusha,	"	"	"	3 40
	Dallas Hart,	"	"	"	2 20
	W. E. Norton,	"	"	"	2 20
	George Deuell,	"	"	"	2 00
	Frederick Ballon,	"	"	"	3 00
	Eugene Doolittle,	"	"	"	6 00
	Edward Ackerman,	"	"	"	2 00
	Byron Doolittle,	"	"	"	2 00
	Dyer Ackerman,	"	"	"	1 20
	Norton E. Gow,	"	"	"	2 00
				Forward,	$1,902 52

1897.				Brought forward,	$1,902	52
May	Peter Barnett,	services,	Hague,	Warren Co.,	1	00
	I. C. Braisted,	"	"	"	1	00
	Arthur Bradley,	"	"	"	1	20
	Frank Ackerman,	"	"	"	1	00
	Joel Archer,	"	"	"	1	20
	George Lesprance,	"	"	"	5	00
	H. R. Harrington,	"	"	"	3	00
	Thomas Lonergan,	"	"	"	1	60
	Joseph Leavitt,	"	"	"	5	80
	John Miller,	"	"	"	3	00
	A. Yuknaritz,	"	"	"	2	00
	Michael Keralles,	"	"	"	1	00
	Melville Barton,	"	"	"	1	00
	H. G. Esterthorpe,	"	"	"	4	00
	William Newton,	"	"	"	1	20
	George H. Hooper,	"	"	"	2	00
	George L. Neeton,	"	"	"	2	20
	Charles Jordan,	"	"	"	1	20
	Henry Hawtorn,	"	"	"	4	80
	Arthur Lane,	"	"	"	1	20
	William Foot,	"	"	"	1	20
	Mont. Decker,	"	"	"	1	20
	F. Leavitt,	"	"	"	5	80
	George Newton,	"	"	"	3	20
	Thomas E. Gow,	"	"	"	2	00
	Joseph Barnett,	"	"	"	1	40
	Manley Bennett,	"	"	"	2	60
	Phelps Bassett,	"	"	"	3	20
	Ambrose Pease,	"	Caldwell,	"	2	00
	A. J. Loop,	"	"	"	2	00
	Charles Loop,	"	"	"	2	00
	Samuel Chambers,	"	"	"	2	00
	Robert Chambers,	"	"	"	2	00
	West Chambers,	"	"	"	4	00
	Dennis Chambers,	"	"	"	2	00
	John Chambers,	"	"	"	2	00
	W. H. Mea,	"	"	"	2	00
	Sid. Loop,	"	"	"	2	00
	Robert Bell,	"	"	"	4	00
	George Evans,	"	"	"	4	00
	William Crandall,	"	"	"	2	00
	William H. Dongan,	"	"	"	4	00
	Edward Stanton,	"	"	"	2	00
	George Mickle,	"	Hague,	"	2	00
	L. L. Stebbins,	"	"	"	2	00
				Forward,	$2,009	52

1897.				Brought forward,	$2,009 52	
May	George Russell,	services,	Hague,	Warren Co.,	2 00	
	A. Vernon,	"	"	"	2 00	
	F. Odell,	"	"	"	2 00	
	R. H. Wilson,	"	Minerva,	Essex Co.,	28 00	
	W. H. Lawton,	"	Hope,	"	16 00	
	W. J. Rist,	"	Johnsburg,	Warren Co.,	8 00	
	W. Zabriski,	"	Hague,	"	2 00	
	William R. Weed, Chairman, cash on hand, N. Y. State Bank, Albany, N. Y.,				142 50	
						$2,212 02
Balance Septemper 30, 1897,						84 27
						$2,296 29

Fines and Penalties Account for Fiscal Year Ending September 30, 1897.

1896.		RECEIPTS.			
Oct.	1.	Balance in State Bank, Albany,		$5,394 34	
	6.	People vs.	James Herronshow,	22 10	
		"	William Chester,	8 00	
		"	A. E. Stevens,	50 00	
		"	Rose & McVey,	9 00	
		"	F. Nottell,	5 85	
	8.	"	Peter Snyder,	10 00	
		"	Alexander Webber,	5 00	
	9.	"	Andrew Bell,	10 00	
		"	M. Giours,	25 00	
	12.	"	W. & F. Pottenbrugh,	14 00	
		"	Black et al.,	100 00	
	13.	"	S. Leprino,	7 00	
		"	William Pruner,	15 00	
		"	Williams & Sargent,	5 95	
	14.	"	W. C. Nellis,	9 25	
	17.	"	L. Kelly,	50 00	
		"	B. Ashley,	25 00	
		"	W. Bullock,	25 00	
	19.	"	F. Jenks,	9 25	
		"	H. D. Knox,	20 10	
	21.	"	E. Daningburg,	4 00	
		"	Penny & Smith,	15 35	
	22.	"	V. Deitrich,	25 00	
		"	Deford et al.,	145 00	
	23.	"	H. Zrum,	3 55	
	24.	"	O. and A. Niles,	50 00	
	26.	"	George Wickham,	50 00	
		"	R. Irving,	15 25	
		"	R. Cross,	22 00	
		"	Gernan Jones,	39 00	
	29.	"	August Sietz,	5 80	
		"	W. Denton,	6 05	
	30.	"	A. Click,	6 15	
		"	Paddocks et al.,	80 00	
		"	George Perry,	8 00	
					$6,294 99
Nov.	4.	People vs.	John Wendall,	$5 00	
		"	Hazen & Leonard,	20 00	
		"	James Grant,	8 10	
	9.	"	M. Malzer,	7 40	
			Forward,	$40 50	$6,294 99

1896.			Brought forward,	$40 50	$6,294 99
Nov.	9.	People vs.	J. Goetzman,	95	
	10.	"	D. N. Abrams,	69 50	
	14.	"	Benjamin Cleghorn,	28 20	
		"	H. J. Walker,	72 95	
	20.	"	J. A. Strohr,	45 00	
		"	Hiram Rouse,	10 00	
	21.	"	Williams et al.,	225 00	
	23.	"	Clinton Martin,	1 50	
		"	C. J. Bailey,	12 55	
	27.	"	H. D. Bristol,	45 00	
		"	B. F. Shanley,	45 00	
		"	P. Phillips,	24 90	
	28.	"	Edward Snyder,	47 10	
		"	Taintor,	38 60	
	30.	"	R. Cudderback,	10 00	
		"	A. Carlin,	30 30	
					747 05
Dec.	2.	People vs.	F. Wallace,	$8 90	
		"	H. & D. N. Buffet,	17 80	
		"	P. Hall,	8 90	
		"	B. Belmont,	8 90	
	7.	"	Adams, Waring et al.,	33 00	
	8.	"	Davis & Farner,	19 84	
		"	F. Miller,	25 00	
	12.	"	I. H. Davis,	50 00	
		"	A. Misner,	20 00	
		"	G. Rien,	7 35	
	14.	"	O. Daniels,	48 00	
	15.	"	Marshman et al.,	141 90	
	16.	"	E. Meade,	12 90	
	18.	"	George Best,	24 00	
	19.	"	Robert Knight,	14 70	
		"	L. Doolittle,	23 40	
		"	H. Metz,	28 26	
	24.	"	I. Hermance,	8 00	
		"	Roach & Fellows,	10 00	
	28.	"	F. N. Rutand,	25 00	
	30.	"	Frank Julien,	25 00	
					560 85
1897.					
Jan.	1.	People vs.	William Shelp et al.,	$80 00	
	13.	"	Loren & Miller,	17 50	
		"	William Pettitt,	14 30	
		"	W. D. Powell et al.,	62 80	
		"	Ray Hubbell,	116 28	
			Forward,	$290 88	$7,602 89

1897.			Brought forward,	$290 88	$7,602 89
Jan.	14.	People vs.	B. Gaines et al.,	109 15	
	18.	"	F. Ingraham,	1 75	
		"	George Noyes,	5 05	
		"	Seth Gould,	2 50	
	21.	"	Norris & Richmond,	14 40	
	23.	"	James Decker et al.,	40 00	
		"	Lount Latin et al.,	100 00	
	29.	"	James Eaton,	7 85	
					571 58
Feb.	1.	People vs.	A. W. Thayer,	$76 30	
	3.	"	Josh. Cummings,	50 00	
	8.	"	Charles Siebert,	60 00	
	17.	"	Edward Morrison,	25 00	
		"	P. Peabody,	25 00	
		"	Townsend et al.,	29 50	
	24.	"	Jennings, Houghton & Clark,	24 55	
		"	M. Sargent,	9 50	
	25.	"	H. Truesdell,	46 20	
					346 05
March	3.	People vs.	Sidney Masten,	$80 00	
	4.	"	Jacob Sticklemeyer,	24 00	
	5.	"	Harry Floyd,	50 00	
	11.	"	George Wickes,	20 00	
	13.	"	Sheppard et al.,	19 36	
		"	Wesley Backus,	27 10	
	15.	"	Deland & Brainard,	50 00	
	16.	"	Wesley Decker,	20 00	
	18.	"	Peter Daney,	20 69	
	22.	"	Clarence Walden,	25 00	
	24.	"	Van Wart et al.,	11 45	
		"	Raymond et al.,	49 40	
		"	August Zinck,	9 00	
	26.	"	E. Caldine,	10 00	
	29.	"	E. Deiterich,	25 00	
					441 00
April	2.	People vs.	Stevens et al.,	$35 50	
		"	Irwin et al.,	13 80	
	3.	"	Wilcox,	24 50	
	6.	"	Warner,	6 05	
	12.	"	Atwood,	12 10	
		"	Halstead,	8 00	
		"	Twichell,	20 25	
	14.	"	Spencer,	68 00	
		"	Palmatier,	48 50	
	17.	"	Phillip Sawyer,	30 20	
			Forward,	$266 90	$8,961 52

1897.			Brought forward,	$266 90	$8,961 52
April	20.	People vs.	Bisnette,	5 00	
		"	Bull,	70 00	
	21.	"	Ehrenfreed,	7 75	
	26.	"	Judson Avery,	21 20	
	30.	"	Samuel Andres,	20 00	
					390 85
May	4.	People vs.	W. Smith et al.,	$20 00	
		"	William Delair,	25 00	
	7.	"	W. H. Horndorf,	21 90	
	10.	"	Michael Breen,	6 60	
		"	Michael Cummings,	6 60	
		"	J. J. Youmans,	152 50	
	11.	"	William Halsinger,	5 75	
		"	William Van Derwenter,	10 00	
		"	William Dean,	10 00	
	13.	"	Ostrander & Green,	5 60	
	14.	"	Rice Hall et al.,	30 40	
	17.	"	George Cutler,	47 50	
		"	W. R. Downer,	75 00	
		"	Edward Sanford,	10 00	
	18.	"	Marstin et al.,	80 00	
		"	Flynn & Olney,	10 50	
	20.	"	Cavanaugh & Nash,	10 00	
	22.	"	Bradford & Sanford,	23 90	
		"	John Barker,	4 00	
		"	John Roach et al.,	55 00	
	24.	"	Edward Maher,	5 00	
		"	C. B. Chapple,	10 00	
		"	Frederick Norts et al.,	141 25	
	25.	"	B. J. Garlock et al.,	53 00	
		"	Lake Ontario Fish Co.,	128 50	
		"	Frederick Martin et al.,	100 00	
	26.	"	Jacob Rouleston,	13 25	
		"	Frank Burns,	5 00	
	27.	"	George Woodbury,	9 00	
	28.	"	Burton Bense,	17 35	
	29.	"	William Earl,	11 70	
		"	L. Palmer,	15 45	
					1,119 75
June	2.	People vs.	J. N. Brooks,	$18 25	
	3.	"	George Skinner,	44 85	
		"	Wagner et al.,	53 50	
	4.	"	Henry Cram,	5 75	
		"	J. Mustafeldt,	21 25	
		"	J. Gutner,	11 25	
			Forward,	$154 85	$10,472 12

1897.			Brought forward,	$154 85	$10,472 12
June	5.	People vs.	C. C. Dingman,	79 50	
	7.	"	William Squires,	54 95	
		"	J. B. Austin,	25 00	
	9.	"	George Beardsley,	8 00	
		"	Floyd Parker,	103 05	
		"	Henry Leider,	6 25	
		"	E. & J. Kress,	13 50	
		"	Briggs et al.,	42 75	
		"	J. G. Taylor,	24 00	
	10.	"	Constant Jambiel,	37 50	
	12.	"	Herman Kitler,	13 25	
		"	Thomas Larkin,	44 20	
	14.	"	Charles Embrose,	10 00	
		"	J. B. Frazier,	34 90	
	15.	"	Setter et al.,	12 50	
	16.	"	L. S. Wood,	9 00	
		"	W. H. Millis,	7 25	
	18.	"	E. P. Stuart,	7 25	
	21.	"	P. Prims,	7 50	
		"	J. E. Camp,	34 28	
	22.	"	John Short,	41 80	
		"	Porter Skinner,	25 00	
		"	William Payment,	100 00	
	24.	"	William J. Hess et al.,	75 00	
	29.	"	H. C. Niles et al.,	5 00	
	30.	"	McCabe,	2 35	
		"	Williams,	7 00	
					985 63
July	2.	People vs.	Beebe,	$20 00	
		"	Roswell & Moore,	23 50	
	10.	"	Joseph Eldridge,	100 00	
	12.	"	Frank Fuller,	8 55	
	14.	"	Charles Corbett,	50 00	
		"	W. H. Coon et al.,	30 00	
	16.	"	Arthur Rogers,	12 65	
	20.	"	F. T. Baird,	13 25	
	24.	"	Frederick Larson et al.,	15 00	
	27.	"	Benjamin Goeway,	25 00	
	28.	"	Ernest Ellis,	95	
	29.	"	Bruce Dart,	10 00	
		"	Wright & Springer,	23 00	
	30.	"	M. A. Brewster,	10 00	
	31.	"	B. A. Petrie,	25 00	
		"	Hatmaker & Bauer,	5 90	
					372 80
				Forward,	$11,830 55

1897.		Brought forward,		$11,830 55
Aug. 3.	People vs.	Peter Beershaw,	$15 35	
	"	Frederick Keever,	5 00	
	"	Peter Forkell,	5 00	
6.	"	John Walford,	5 00	
9.	"	James Moore,	9 90	
10.	"	Staley et al.,	71 50	
	"	Jay Ayres,	19 80	
13.	"	A. Beershaw,	7 65	
17.	"	John S. Dater,	12 00	
	"	John Tanner,	7 00	
	"	Frederick Brown,	10 00	
	"	Boice,	100 00	
	"	Brandes et al.,	25 08	
20.	"	O'Hara,	47 00	
26.	"	F. Beede,	9 90	
31.	"	Guthrie,	20 00	
	"	Vosburg,	8 00	
	"	Pitcher,	13 25	
	"	Place et al.,	15 00	
				406 43
Sept. 2.	People vs.	George Cardiff,	$50 00	
	"	John Winchell,	23 50	
3.	"	Andrew Todd,	10 00	
4.	"	George Blevins,	38 00	
5.	"	O. L. Beede,	50 00	
7.	"	Roy Beardsley,	20 00	
8.	"	C. Define,	19 00	
14.	"	George Codner,	85 00	
15.	"	William Hennings,	9 00	
16.	"	H. Schoonmaker,	26 03	
20.	"	D. Trembley et al.,	50 00	
	"	L. Martin,	18 47	
27.	"	George Fink,	23 50	
	"	Jay Van Buren,	10 00	
28.	"	A. Moore,	100 00	
30.	"	C. Little et al.,	19 90	
				552 40
	Total Receipts,			$12,789 38

DISBURSEMENTS.

1896.			
Oct. 6.	Alvin Winslow,	moiety,	$9 00
	Simon Marshall,	"	3 82
	F. S. Beede,	"	12 00
		Forward,	$24 82

1896.			Brought forward,	$24 82	
Oct.	6.	Simon Marshall,	moiety,	2 50	
		Edgar Hicks,	"	5 00	
		Ira Elmendorf,	"	8 52	
		William Cookingham,	"	6 00	
		J. E. Leavitt,	"	6 60	
		H. W. Schuman,	"	10 00	
		Charles Van Stenberg,	"	5 00	
		E. J. Brooks,	"	10 50	
		J. H. Lamphere,	"	10 00	
		Simon Marshall,	"	10 00	
		Sebastian Hesback,	"	7 50	
		James Holmes,	"	3 57	
		E. J. Lobdell,	"	19 50	
		E. Hathway,	"	6 37	
		J. E. Leavitt,	"	11 50	
		L. S. Emmons,	"	10 40	
		F. M. Potter,	"	10 95	
		J. L. Ackley,	"	10 00	
		E. J. Lobdell,	legal costs,	76 72	
		George Cook,	"	12 65	
		John Desmond,	attorney costs,	15 00	
		Robert Thompson,	legal costs,	11 34	
		A. B. Strough,	expenses,	4 06	
		W. J. Sanders,	legal costs,	15 00	
					$313 50
Nov.	6.	Robert Thompson,	legal costs,	$10 94	
		J. E. Leavitt,	moiety,	11 05	
		E. J. Lobdell,	"	4 00	
		G. S. Sackett,	"	24 25	
		Ira Elmendorf,	"	4 50	
		E. A. Hazen,	"	2 92	
		William Cookingham,	"	5 00	
		Simon Marshall,	"	2 50	
		William Cookingham,	"	5 00	
	9.	Joseph Enger,	"	12 50	
	12.	William Cookingham,	"	7 00	
	13.	J. W. Lisk,	"	3 75	
		W. L. Reed,	"	1 82	
		A. Warren,	"	2 97	
		J. E. Leavitt,	"	4 62	
		John Hunkins,	"	50 00	
		J. E. Leavitt,	"	4 62	
		H. S. McArthur,	legal expenses,	11 30	
		W. H. Flack,	"	31 95	
		L. S. Emmons,	"	10 00	
			Forward,	$210 69	$313 50

1896.			Brought forward,	$210 69	$313 50
Nov. 13.	Albert Warren,	legal expenses,		2 00	
	James Wright,	"		23 25	
	J. E. Leavitt,	moiety,		10 05	
	Simon Marshall,	"		2 00	
	W. E. Roberts,	legal costs,		13 00	
	Simon Marshall,	moiety,		7 50	
	Michael McQuinn,	"		7 67	
	Joseph Canipi, Jr.,	"		36 25	
	E. J. Brooks,	"		1 77	
	W. L. Reed,	"		22 30	
	E. J. Lobdell,	"		19 50	
	L. S. Emmons,	"		11 00	
	F. S. Beede,	"		24 00	
	Michael McQuinn,	"		7 62	
	Robert Taylor,	justice fees,		3 00	
	Morgan Van Buren,	special detective,		57 80	
	B. Saulsbury,	moiety,		5 87	
	Edward Coons,	justice,		5 15	
	Michael McQuinn,	"		3 35	
	Frank Shedrick,	expenses,		2 40	
	J. W. Littlejohn,	moiety,		40 00	
	Joseph Sterling,	"		4 00	
	E. I. Brooks,	"		3 07	
	H. W. West,	costs of court,		1 50	
	Frank Brown,	attorney,		25 00	
	L. V. Thayer,	judgment,		111 79	
	Simon Marshall,	expenses and services,		64 37	
	New York State Bank, J. S. Black,	protested check,		101 33	
					827 23
Dec. 8.	L. H. Boyington,	moiety,		$10 00	
	Edgar Hicks,	"		2 50	
	J. D. Lawrence,	"		4 05	
	Nelson Mantle,	constable fees,		9 55	
	Simon Marshall,	justice,		5 10	
	D. N. Pomeroy,	moiety,		4 17	
	George Cook,	costs of court,		5 25	
	E. J. Lobdell,	moiety,		28 92	
	Albert Warren,	"		36 47	
	B. H. McCollum,	"		14 10	
	Homer Hall,	constable,		6 00	
	W. H. Coon,	attorney,		10 00	
	Edwin Young,	justice,		1 85	
	W. H. Coon,	attorney,		10 50	
	J. W. Lisk,	moiety,		22 50	
	J. E. Leavitt,	"		5 00	
			Forward,	$175 96	$1,140 73

1896.			Brought forward,	$175 96	$1,140 73
Dec. 8.	Joseph Canipi, Jr.,	moiety,		112 50	
	J. D. Lawrence,	"		6 27	
	William Harris,	"		75	
	Edgar Hicks,	"		22 50	
	J. W. Lisk,	"		22 50	
	B. Saulsbury,	"		12 45	
	S. H. Seymour,	justice fees,		10 60	
	George Carver,	constable fees,		43 65	
	A. O. Fish,	justice fees,		10 00	
	E. J. Brooks,	moiety,		23 55	
	Eugene Hathway,	"		19 30	
	James Wright,	attorney,		55 00	
	Willett Kidd,	moiety,		5 00	
	J. W. Pond,	"		15 15	
	W. L. Sullivan,	"		8 70	
	A. G. Patterson,	attorney,		10 40	
	Joseph Canipi, Jr.,	"		36 00	
	J. A. Conklin,	expenses,		73 00	
					663 28
1897.					
Jan. 5.	E. W. Herman,	attorney,		$77 73	
	W. E. Newton,	moiety,		8 90	
	E. A. Hazen,	"		13 35	
	Robert Eddy,	services,		7 40	
	A. W. Fetterly,	justice,		5 00	
	Albert Warren,	moiety,		12 50	
	E. I. Brooks,	"		3 67	
	Willett Kidd,	"		35 00	
	J. W. Lisk,	"		25 09	
	Bernard Saulsbury,	"		16 50	
	Eugene Hathway,	"		9 92	
	James Holmes,	"		70 95	
	E. H. Tamsen,	sheriff fees,		1 75	
	A. B. Strough,	witness fees,		18 83	
	H. C. Severance,	justice fees,		5 10	
	L. S. Emmons,	moiety,		6 45	
	O. S. Potter,	"		12 00	
	P. S. Beede,	"		24 00	
	Henry French,	costs,		12 70	
	B. Saulsbury,	moiety,		7 35	
	James Holmes,	"		11 70	
	Simon Marshall,	"		14 13	
	L. S. Emmons,	costs,		7 50	
	Charles Waldron,	"		5 15	
	William Cookingham,	moiety,		4 00	
			Forward,	$416 67	$1,804 01

1897.			Brought forward,	$416 67	$1,804 01
Jan. 5.	D. Kesselbrack,	moiety,		5 00	
	A. G. Patterson,	attorney,		30 22	
	Tice & Vicary,	attorneys,		40 06	
	Percy Landsdowne,	attorney,		10 00	
	George F. Rose,	justice,		2 80	
	Hoag & Hammond,	attorneys,		80 00	
	F. S. Whipple,	attorney,		5 00	
	E. J. Lobdell,	moiety,		12 50	
	John K. Ward,	justice,		4 70	
					606 95
Feb. 4.	Joseph Canipi, Jr.,	moiety,		$12 50	
	Simon Marshall,	"		37 13	
	J. D. Lawrence,	"		31 40	
	C. Van Steenburg,	"		8 75	
	Michael McQueen,	"		7 15	
	E. I. Brooks,	"		54 57	
	Simon Marshall,	"		1 25	
	Mason & Kellogg,	attorney fees,		6 00	
	H. R. Follett,	justice,		15 87	
	William Norwood,	constable,		12 00	
	J. J. Bixby,	attorney fees,		25 00	
	Edward Oakley,	moiety,		87	
	E. J. Lobdell,	"		2 52	
	William B. Broker,	attorney fees,		17 50	
	A. W. Fetterly,	justice,		6 00	
	C. C. Vincent,	witness fees,		6 48	
	Willett Kidd,	moiety,		20 00	
	James Fox,	justice fees,		5 80	
	William Cookingham,	moiety,		50 00	
	Joseph Raush,	"		3 20	
	E. R. Brown,	attorney fees,		160 00	
	John H. Clagston,	moiety,		8 00	
	J. D. Lawrence,	"		3 92	
	L. S. Emmons,	"		38 15	
	E. J. Lobdell,	"		46 87	
	E. J. Lobdell,	witness costs,		37 84	
	D. N. Pomeroy,	"		9 94	
	F. J. Davis,	attorney costs,		15 00	
					643 71
March 9.	William Cookingham,	moiety,		$25 00	
	J. W. Tucker,	attorney costs,		5 00	
	W. H. Hull,	justice costs,		7 45	
	G. W. Smith,	attorney costs,		20 00	
	D. W. Miller,	"		10 00	
	B. H. McCollum,	moiety,		25 00	
			Forward,	$92 45	$3,054 67

1897.			Brought forward,	$92 45	$3,054 67
March 9.	Charles Knox,	moiety,		14 75	
	Albert Warren,	"		17 02	
	J. H. Brandow,	justice costs,		5 80	
	E. I. Brooks,	moiety,		20	
	F. O. Conant,	"		23 10	
	E. J. Lobdell,	witness costs,		3 77	
	J. J. Spencer,	attorney costs,		10 00	
	M. W. Carnahan,	constable costs,		2 00	
	Henry French,	"		6 00	
	H. A. Carnahan,	justice costs,		6 15	
	O. E. Beede,	constable costs,		2 95	
	William F. Bailey,	jüctice costs,		7 80	
	A. R. Gibbs,	attorney costs,		5 00	
	Charles T. Seegar,	constable costs,		12 52	
	B. W. Hoye,	justice costs,		11 05	
	Borden D. Smith,	attorney costs,		15 00	
	Carlos Hutchins,	moiety,		22 50	
	J. W. Pond,	"		12 00	
	W. H. Burnet,	"		16 00	
	William Cookingham,	"		40 00	
					326 06
April 7.	J. L. Tucker,	attorney fees,		$5 00	
	Albert Warren,	constable fees,		3 40	
	William H. Gardner,	sheriff fees,		5 00	
	M. H. Aylesworth,	court costs,		50 00	
	Edward Vanderwenter,	justice costs,		6 00	
	H. H. Widener,	attorney costs,		71 55	
	W. C. Hull,	justice costs,		4 20	
	E. A. Hazen,	court costs,		23 40	
	O. S. Goucher,	"		4 55	
	C. E. Ernest,	constable fees,		3 85	
	Taylor & Nichols,	attorney costs,		10 00	
	Strong & Daly,	"		23 00	
	George D. Flagler,	constable costs,		2 00	
	A. W. Payne,	justice costs,		3 15	
	James Toole,	"		3 75	
	S. H. Blythe,	"		10 55	
	William Thompson,	constable costs,		4 45	
	B. W. Hoye,	justice costs,		7 12	
	Sammis & Biercke,	attorney costs,		32 25	
	E. A. Hazen,	court costs,		2 10	
	Willett Kidd,	moiety,		10 00	
	E. A. Hazen,	"		12 50	
	H. L. Wait,	"		9 68	
	J. W. Pond,	court costs,		4 50	
			Forward,	$312 00	$3,380 73

1897.			Brought forward,	$312 00	$3,380 73
April	7.	W. H. Worts,	justice costs,	35 65	
		D. N. Pomeroy,	moiety,	12 50	
		Carlos Hutchins,	"	10 34	
		Dudley & Childs,	attorney fees,	5 00	
		G. W. Hurlbut,	"	13 00	
		T. C. Wilson,	justice fees,	2 55	
		Carlos Hutchins,	witness costs,	9 50	
		William H. Burnett,	moiety,	9 00	
		J. W. Lisk,	expense Sloop Jessie,	70 00	
		D. N. Pomeroy,	moiety,	25 00	
		M. D. Lavergne,	"	4 50	
		Thomas J. Comstock,	"	24 70	
		Royal E. Taylor,	"	5 72	
		L. S. Emmons,	"	5 00	
		Edgar Hicks,	"	9 37	
		Willett Kidd,	"	10 00	
					563 83
May	6.	Frank Cummings,	attorney fees,	$15 00	
		James E. Herbert,	constable fees,	1 85	
		E. C. Smith,	"	2 25	
		James E. Herbert,	costs,	1 85	
		Smith & Thomas,	attorney costs,	20 16	
		T. H. Donnelly,	moiety,	3 02	
		E. I. Brooks,	"	17 75	
		H. D. Cole,	mounting fish,	10 00	
		William Cookingham,	moiety,	6 90	
		L. S. Emmons,	expenses,	28 86	
		Charles Vogelsang,	moiety,	12 25	
		Joseph F. Fox,	justice fees,	4 65	
		Spencer Hawn,	use of launch,	50 00	
		Sammis & Bierck,	attorney fees,	6 25	
		F. M. Potter,	moiety,	10 12	
		E. A. Hazen,	"	5 00	
		J. D. Lawrence,	"	4 00	
		E. J. Lobdell,	"	34 00	
		J. E. Leavitt,	"	24 25	
		J. F. Shedden,	"	2 55	
		Joseph Northup,	"	35 00	
		E. A. Hazen,	costs,	3 05	
		E. B. Mitchell,	attorney fees,	6 25	
		J. L. Tucker,	"	26 32	
		R. R. McLane,	justice fees,	13 85	
		J. W. Webb,	attorney fees,	22 00	
		B. W. Hoye,	justice fees,	3 15	
		John H. Booth,	attorney fees,	25 00	
			Forward,	$395 33	$3,944 56

1897.		Brought forward,	$395 33	$3,944 56
May 6.	C. T. Seeger,	constable fees,	8 45	
	E. A. Hazen,	court costs,	2 10	
	Lockwood & Hill,	"	306 28	
	L. S. Emmons,	"	5 05	
	D. N. Pomeroy,	moiety,	3 87	
	Dudley & Child,	attorney,	10 00	
	Willett Kidd,	court costs,	19 28	
	L. S. Emmons,	moiety,	10 60	
	T. H. Donnelly,	"	10 00	
	Sammis & Bierck,	attorney,	227 30	
				998 26
June 7.	E. I. Brooks,	moiety,	$17 55	
	T. H. Donnelly,	"	10 00	
	M. M. Compson,	attorney,	32 65	
	J. L. Ackley,	moiety,	5 00	
	Henry French,	"	2 87	
	L. S. Emmons,	"	76 25	
	"	court costs,	39 49	
	E. A. Hazen,	moiety,	12 50	
	Henry Lake,	constable,	4 75	
	P. M. Parker,	justice,	1 75	
	Smith Soule,	attorney,	10 00	
	E. C. Smith,	court costs,	10 75	
	J. P. Weaver,	constable,	3 95	
	Isaac Hess,	"	1 30	
	J. W. Titcomb,	use of launch,	29 25	
	Cy Fullington,	services,	22 50	
	J. L. Ackley,	moiety,	5 00	
	George B. Smith,	"	2 80	
	L. S. Emmons,	"	23 75	
	N. Shaul,	"	15 20	
	Joseph Northup,	"	37 50	
	J. L. Ackley,	"	5 00	
	S. C. Beeman,	constable,	1 45	
	H. Brown,	attorney,	15 00	
	B. T. Burnett,	services and expenses,	15 26	
	W. H. Burnett,	" "	31 13	
	E. C. Smith,	justice,	4 50	
	John R. Odell,	expenses,	11 13	
	Charles McMaster,	attorney,	5 00	
	T. H. Donnelly,	moiety,	40 00	
	H. W. Sherman,	"	5 00	
	J. E. Herbert,	constable,	7 00	
	E. H. Woodruff,	court costs,	4 80	
	Edward S. Coons,	justice fees,	6 00	
		Forward,	$516 08	$4,942 82

1897.				Brought forward,	$516 08	$4,942 82
June	7.	George W. Maxon,	justice fees,		11 11	
		D. N. Pomeroy,	court costs,		2 41	
		J. E. Leavitt,	moiety,		6 62	
		E. J. Lobdell,	court costs.		45 60	
		E. J. Brooks,	moiety,		8 67	
		E. E. Thomas,	constable,		2 50	
		Henry French,	"		6 55	
		J. W. Littlejohn,	moiety,		44 71	
		C. S. Gifford,	"		2 50	
		F. S. Beede,	"		4 50	
		Joseph Northup,	"		50 00	
		E. I. Brooks,	"		2 00	
		A. C. Smith,	"		27 50	
		T. H. Donnelly,	"		14 45	
		J. L. Ackley,	"		5 00	
		J. F. Shedden,	"		5 85	
		J. E. Leavitt,	"		26 50	
		Clement Miller,	constable,		18 05	
		Ward Compson,	attorney,		6 00	
		M. M. Compson,	"		13 50	
		B. B. Reade,	justice,		13 05	
		Louis Deuchler,	"		6 50	
		Egbert Palmer,	attorney,		25 00	
		John A. Strong,	justice,		18 66	
		Norman Pomeroy,	constable,		17 05	
		James J. Redman,	"		11 50	
		Anson Harder,	attorney,		28 50	
		Charles Latham,	court costs,		16 60	
		A. K. Botsford,	attorney,		10 58	
		E. I. Brooks,	moiety,		22 42	
		William Cookingham,	"		7 72	
		Ackerly & Miles,	attorneys,		182 40	
						1,180 08
July	6.	L. S. Emmons,	moiety,		$9 12	
		D. N. Pomeroy,	"		52 86	
		George Bush,	"		2 87	
		J. E. Leavitt,	"		39 75	
		E. J. Lobdell,	"		12 50	
		W. L. Reed,	"		27 47	
		B. H. McCollum,	"		12 00	
		James Holmes,	"		21 37	
		F. S. Beede,	"		45 00	
		T. H. Donnelly,	"		4 00	
		J. W. Lisk,	"		18 75	
		E. J. Brooks,	"		22 10	
				Forward,	$267 79	$6,122 90

1897.		Brought forward,	$267 79	$6,122 90
July 6.	J. E. Leavitt,	moiety,	6 62	
	J. L. Ackley,	"	5 00	
	D. N. Pomeroy,	"	6 25	
	A. C. Smith,	"	3 62	
	Albert Warren,	"	4 50	
	G. L. Sackett,	"	3 62	
	Frank Lowe,	"	17 45	
	Edgar Hicks,	"	3 75	
	L. S. Emmons,	"	17 14	
	George H. Smith,	"	58 40	
	E. C. Smith,	court costs,	30 70	
	Henry Lake,	constable costs,	27 45	
	James E. Herbert,	"	20 05	
	Isaac Hess,	"	12 90	
	Frank Lowe,	court costs,	1 40	
	W. C. Hills,	justice costs,	1 75	
	F. L. French,	constable costs,	2 20	
	John A. Adams,	justice costs,	1 25	
	F. H. Baker,	attorney costs,	10 00	
	Willett Kidd,	witness costs,	11 50	
	P. G. Klem,	constable costs,	2 01	
	D. S. Chamberlain,	justice costs,	44 90	
	E. B. Miller,	"	4 50	
	B. H. McCollum,	moiety,	50 00	
	A. B. Strough,	expenses,	18 87	
	A. C. Smith,	"	3 50	
	E. I. Brooks,	"	1 17	
	Howard Widener,	attorney costs,	30 00	
	Taylor & Nichols,	"	15 00	
	James Holmes,	"	15 00	
	Frederick H. Baker,	"	10 00	
	C. F. Giles,	justice costs,	25 00	
	Frederick Kuntzsch,	attorney costs,	89 98	
				823 27
Aug. 6.	Albert Warren,	moiety,	$12 50	
	W. L. Reed,	"	11 75	
	J. L. Ackley,	"	10 00	
	J. H. Lamphere,	"	50 00	
	William Everson,	"	4 27	
	Charles Van Steenberg,	"	15 00	
	William R. Pitts,	sheriff costs,	11 25	
	Milton Carter,	attorney costs,	2 00	
	Carlton Miner,	constable costs,	2 00	
	C. S. Mereness,	attorney costs,	2 00	
	Landsford Wallace,	justice costs,	2 00	
		Forward,	$122 77	$6,946 17

1897.				Brought forward,	$122 77	$6,946 17
Aug.	6.	W. H. Egleton,	justice costs,		3 40	
		Myron Wicks,	constable costs,		9 50	
		F. C. Trumbell,	attorney costs,		10 00	
		L. S. Emmons,	moiety,		6 32	
		J. E. Leavitt,	"		6 62	
		Simon Marshall,	"		7 50	
		J. E. Leavitt,	"		12 50	
		B. Saulsbury,	"		47	
		J. D. Lawrence,	"		5 00	
		J. S. Whipple,	attorney costs,		70 00	
		James E. Herbert,	constable costs,		4 30	
		Charles D. Gardiner,	justice costs,		13 75	
		Henry French,	moiety,		16 90	
		C. L. Smith,	attorney costs,		25 00	
		M. C. Perry,	"		10 00	
		Philip Keck,	"		200 00	
		W. L. Reed,	moiety,		2 95	
		E. A. Hazen,	"		12 50	
		R. M. Rush,	"		11 50	
		Edward Thompson,	court costs,		40 50	
		E. C. Smith,	attorney costs,		10 00	
		W. H. Ronerdink,	justice costs,		4 35	
		Udele Bartlett,	attorney costs,		42 83	
		Charles R. Coville,	"		126 29	
		Dudley & Childs,	"		75 00	
		C. L. Smith,	"		10 75	
		Miles Kennedy,	moiety,		5 00	
		A. J. Mulligan,	expenses,		21 85	
						887 55
Sept.	6.	James Holmes,	moiety,		$35 75	
		J. F Shedden,	"		2 67	
		Simon Marshall,	"		5 00	
		J. L. Ackley,	"		4 95	
		Thomas Carmody,	attorney costs,		10 00	
		James Holmes,	"		2 52	
		T. H. Donnelly,	"		12 54	
		Carlos Hutchins,	"		50 00	
		Alvin Winslow,	"		5 00	
		E. C. Smith,	"		15 75	
		John H. Booth,	"		10 00	
		J. H. Slater,	constable costs,		8 50	
		B. W. Loring,	justice costs,		21 30	
		J. W. Pond,	sheriff costs,		7 19	
		J. A. Spencer,	justice costs,		16 55	
		John L. Ackley,	moiety,		4 95	
				Forward,	$212 67	$7,833 72

1897.			Brought forward,	$212 67	$7,833 72
Sept.	6.	John E. Leavitt,	moiety,	10 62	
		George H. Reed,	justice fees,	5 20	
		George H. Bunce,	"	10 00	
		Isaac Hess,	constable fees,	8 00	
		James E. Herbert,	"	8 20	
		Simon Marshall,	moiety,	10 62	
		Frederick L. Clock,	justice fees,	10 13	
		Frederick H. Baker,	attorney fees,	10 00	
		Smith & Castleman,	"	10 00	
		E. C. Smith,	justice fees,	8 05	
		John Park,	constable,	7 00	
		J. C. Little,	attorney,	10 00	
		John N. Kumso,	constable,	9 20	
		Daniel L. Barman,	attorney,	10 00	
		Sammis & Bierck,	attorneys,	400 00	
	30.	Carlton Miner,	constable,	1 50	
		Frederick L. Clock,	justice,	3 00	
		L. S. Emmons,	moiety,	16 75	
		Joseph Northup,	"	19 00	
		F. S. Beede,	"	34 50	
		T. H. Donnelly,	"	10 00	
		Alvin Winslow,	"	42 50	
		Robert S. Jones,	"	4 50	
		B. H. McCollum,	"	50 00	
		D. N. Pomeroy,	"	13 01	
		Root, Orton & Baldwin,	attorneys,	20 00	
		J. L. Tucker,	attorney,	10 00	
		Rich & Aiken,	attorneys,	8 73	
		Frank Lowe,	moiety,	10 00	
		Max L. Bevins,	attorney,	10 00	
		L. S. Emmons,	moiety,	9 23	
		J. F. Shedden,	"	3 82	
		George H. Lamy,	sheriff,	10 00	
		Charles Vogelsang,	moiety,	5 00	
		Albert Warren,	"	50 00	
		John E. Leavitt,	"	11 75	
					1,082 98
		Total Disbursements,			$8,916 70
Balance September 30, 1897, in State National Bank, Albany, N. Y.,					3,872 68
					$12,789 38

Trespass on State Lands.

RECEIPTS.

1896.				
Oct.		To balance in State Bank,	$238 70	
Dec.	29.	People vs. P. Monihan,	60 00	
	30.	" A. DeGolver,	55 00	
	31.	" Townsend & Stedman,	300 00	
		" W. A. Elliott,	46 60	
1897.				
Jan.	12.	" Frank Houghton,	125 00	
	18.	" Danforth & Page,	20 00	
Feb.	2.	" J. M. Peters,	125 00	
	12.	" W. Briggs,	14 15	
	25.	" L. Gifford,	20 00	
Mch.	3.	" R. Cleveland,	10 00	
		" T. Quillian,	15 00	
		" J. C. Shulenberg,	200 00	
	4.	" Freegrace White,	32 00	
	18.	" Sutton et al.,	365 97	
	23.	" E. Darling,	100 00	
		" D. G. Helms,	236 03	
April	3.	" Van Allen,	23 00	
		" Merrill,	20 49	
	6.	" Otis et al.,	125 00	
	12.	" Merrill,	51	
	30.	" Isaac Hayes et al.,	82 50	
May	4.	" J. R. Willard,	50 00	
	5.	" James Rogers,	125 00	
	27.	" Stephen Baum,	22 50	
	31.	" John Hoar,	130 00	
June	2.	" Frederick Kirch,	50 00	
	4.	" Charles Ormsby,	10 00	
	9.	" A. Sperl,	58 00	
	24.	" George Carlin,	30 00	
		" Leonard Lane,	100 00	
		" Morgan Lumber Co.	50 00	
July	12.	" Joseph Harvey,	10 00	
Aug.	17.	" Scott Patterson,	50 00	
Sept.	2.	" Sweet et al.,	30 00	
	9.	" Matthew Armer,	300 00	
	11.	" D. G. Helms,	29 83	
		" J. E. Leavitt, witness fees returned,	23 49	
		Total Receipts,		$3,283 77

1896.			DISBURSEMENTS.	
Oct.	13.	J. W. Littlejohn,	surveying,	$53 50
		A. Hutchins,	"	67 75
		Cyrus Drury,	"	33 50
		James P. Brownell,	"	22 13
Dec.	8.	E. W. Lindsley,	"	18 25
	15.	Sewell Braley,	"	6 00
	26.	R. Kelsey,	"	21 48
		A. Hutchins,	"	20 75
	31.	T. E. Hancock,	legal fees,	40 00
		"	"	100 00
1897.				
Jan.	2.	John E. Leavitt,	moiety,	25 00
	4.	Charles A. Taylor,	costs of court,	95 60
		Carlos Hutchins,	moiety,	25 00
	20.	Cyrus Drury,	surveying,	142 75
		C. N. Woodworth,	"	45 00
		J. E. Leavitt,	expenses,	29 84
		J. D. Lawrence,	moiety,	23 30
	25.	H. C. Williard,	witness expenses,	26 01
	26.	S. J. Palmer,	surveying,	27 00
		J. E. Leavitt,	moiety,	25 00
Feb.	4.	S. J. Palmer,	surveying,	10 00
		Carlos Hutchins,	moiety,	10 00
	16.	J. E. Leavitt,	"	7 07
		C. N. Woodworth,	surveying,	46 15
	22.	E. J. Lobdell,	moiety,	10 00
		"	"	5 00
		"	"	7 50
		John E. Leavitt,	"	25 00
	17.	Nicholas Shaul,	"	16 00
		E. Fischer,	services,	12 00
Mch.	17.	John E. Leavitt,	expenses,	7 54
		Cyrus Drury,	surveying,	45 00
		J. W. Pond,	expenses,	50 00
	22.	Carlos Hutchins,	moieties,	182 98
	26.	E. J. Lobdell,	"	25 00
		B. D. Smith,	attorney,	15 00
April	9.	George W. Smith,	"	5 00
		J. C. Ware,	justice,	1 50
		Edward Kennedy,	constable,	8 20
	22.	J. E. Leavitt,	moiety,	11 50
		J. W. Littlejohn,	"	62 50
		J. A. Booth,	justice fees,	15 00
		J. W. Littlejohn,	expenses,	4 50
		W. E. Boshey,	"	23 25
			Forward,	$1,453 55

1897.			Brought forward,	$1,453 55
April	22.	C. W. Miller,	services,	25 50
May	3.	J. W. Littlejohn,	moiety,	41 25
	12.	C. O. Bartlett,	"	25 00
		E. J. Lobdell,	"	25 00
		G. T. Chillis,	surveying,	6 00
		S. J. Palmer,	"	60 50
		C. D. Gibson,	"	24 00
	20.	Almanzo Hutchins,	"	31 50
		Vernon Bruce,	"	4 50
		Loren Kelley,	services,	10 00
		O. B. Lappell,	"	16 00
		Edward Butler,	"	10 00
	24.	E. J. Lobdell,	expenses,	36 36
June	2.	J. E. Leavitt,	moiety,	11 25
		E. J. Lobdell,	"	25 00
		H. L. Wait,	"	24 52
		E. M. Merrill,	surveying,	175 00
		Carlos Hutchins,	legal expenses,	24 00
	7.	John E. Leavitt,	"	50 00
	20.	C. O. Bartlett,	moiety,	5 00
		John E. Leavitt,	"	25 00
		E. J. Lobdell,	"	25 00
	26.	C. N. Woodworth,	surveying,	14 00
		Cyrus Drury,	"	10 00
		E. M. Merrill,	"	44 17
July	15.	E. J. Lobdell,	moiety,	25 00
		Carlos Hutchins,	"	3 00
		N. Shaul,	surveying,	16 00
		James Green,	"	12 50
		S. J. Palmer,	"	53 12
Aug.	2.	Carlos Hutchins,	"	7 50
		William Ballard,	"	9 00
		N. Shaul,	"	16 25
Sept.	2.	J. W. Littlejohn,	moiety,	5 00
	20.	E. J. Lobdell,	"	15 00
		James Green,	"	23 02
		J. R. Van Ness,	attorney,	34 25
		Carlos Hutchins,	moiety,	31 00

Total Disbursements,	$2,452 74
Balance State Bank, Albany, N. Y., Sept. 30, 1897,	831 03
	$3,283 77

Rentals from State Lands.

RECEIPTS.

1896.				
Oct.	8.	Florence E. Ranger,	$50 00	
	23.	Henry Bradley,	40 00	
Nov.	10.	J. B. Henderson,	50 00	
		Albert Judson,	50 00	
1897.				
June	29.	E. & B. Manierre,	150 00	
		Ann H. Manierre,	150 00	
July	3.	William P. Mason,	150 00	
		Jerome Lapham,	75 00	
	6.	C. T. Kirby,	50 00	
		A. G. Gerster,	200 00	
		W. D. Mann,	50 00	
	8.	J. B. Henderson,	50 00	
	29.	T. H. Stott,	20 00	
Aug.	17.	W. R. Wait,	30 00	
	20.	Delavan Bloodgood,	75 00	
		Florence E. Ranger,	50 00	
		Thomas P. Wicks,	30 00	
Sept.	5.	Cecil Gabbitt,	100 00	
		Total Receipts,		$1,370 00

DISBURSEMENTS.

1896.				
Oct.	8.	James A. Roberts, Comptroller,	$50 00	
Nov.	12.	" "	90 00	
Dec.	14.	" "	50 00	
1897.				
July	8.	" "	875 00	
Aug.	13.	" "	20 00	
Sept.	9.	" "	285 00	
		Total Disbursements,		$1,370 00

Schedule of Licenses Issued to Net Fish and of Receipts for Same for Year Ending September 30, 1897.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
Samuel Wood,	Brewerton,	1 trap,	Oneida Lake,	$1 00
Jay Shaver,	"	"	"	1 00
Frederick Schell,	"	"	"	1 00
William Yerton,	"	"	"	1 00
F. M. Dickson,	"	"	"	1 00
Albert Fayle,	"	"	"	1 00
Aaron Landers,	"	"	"	1 00
Oscar Eaton,	"	"	"	1 00
Nelson Ladd,	"	"	"	1 00
John Pomeroy,	"	"	"	1 00
Jasper Pomeroy,	"	"	"	1 00
John Wood,	"	"	"	1 00
Charles Foster,	"	"	"	1 00
B. Wood,	"	"	"	1 00
Simon Deniger,	"	"	"	1 00
D. C. Wood,	"	"	"	1 00
William Phillips,	West Monroe,	"	"	1 00
David Johnson,	"	"	"	1 00
John Shaw,	"	"	"	1 00
Arthur Hoatland,	Cicero,	"	"	1 00
John H. Davison,	Cigarville,	"	"	1 00
William H. Morey,	West Monroe,	"	"	1 00
Dexter W. Ostram,	"	"	"	1 00
			Forward,	$23 00

SCHEDULE OF LICENSES.—CONTINUED.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$23 00
Albert Shaw,	West Monroe,	1 trap,	Oneida Lake,	1 00
John Judge,	"	"	"	1 00
Frederick C. Haas,	Brewerton,	"	"	1 00
Edgar M. Becker,	"	"	"	1 00
Gurnon Emmons,	"	"	"	1 00
F. T. Emmons,	"	"	"	1 00
George F. Lynn,	"	"	"	1 00
Ivan D. Schell,	"	"	"	1 00
Morris Schell,	"	"	"	1 00
J. H. Schell,	"	"	"	1 00
C. F. Davison,	"	"	"	1 00
J. B. Davison,	"	"	"	1 00
Sanford Belknap,	"	"	"	1 00
H. S. Dutcher,	"	"	"	1 00
Jerome Ladd,	"	"	"	1 00
Charles Hines,	"	"	"	1 00
William J. Hines,	"	"	"	1 00
Charles Sterling,	"	"	"	1 00
Alexander Bouton,	"	"	"	1 00
James Walker,	"	"	"	1 00
John Walker,	"	"	"	1 00
Cicero Walker,	"	"	"	1 00
Forest Walker,	"	"	"	1 00
E. L. Hines,	"	"	"	1 00
Robert Hines,	"	"	"	1 00
			Forward,	$48 00

SCHEDULE OF LICENSES.—CONTINUED.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$48 00
Herbert Hines,	Brewerton,	1 trap,	Oneida Lake,	1 00
Eugene Landers,	"	"	"	1 00
Simon McAlister,	"	"	"	1 00
George Whitney,	"	"	"	1 00
John Wise,	Cicero,	"	"	1 00
Freeman Crowell,	"	"	"	1 00
Charles Crowell,	"	"	"	1 00
H. R. Lynn,	"	"	"	1 00
Lorenzo Shaw,	West Monroe,	"	"	1 00
Charles Shaw,	"	"	"	1 00
Judson Judge,	"	"	"	1 00
C. H. Livingston,	Brewerton,	"	"	1 00
Anson E. Landers,	"	"	"	1 00
Frank Landers,	"	"	"	1 00
Ernest Landers,	"	"	"	1 00
E. G. Gale,	"	"	"	1 00
Frank Nicholson,	"	"	"	1 00
Clark Vincent,	"	"	"	1 00
H. M. Lynn,	"	"	"	1 00
John Meany,	"	"	"	1 00
William Waldron,	"	"	"	1 00
Asa D. Ladd,	Cigarville,	"	"	1 00
William H. Hughson,	"	"	"	1 00
D. C. Ladd,	"	"	"	1 00
Jerome J. Ladd,	"	"	"	1 00
			Forward,	$73 00

SCHEDULE OF LICENSES.—CONTINUED.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$73 00
C. R. Ladd,	Cigarville,	1 trap,	Oneida Lake,	1 00
Lucius Wood,	Constantia,	"	"	1 00
William Davis,	Cicero,	"	"	1 00
Phillip Andrews,	Cicero Centre,	"	"	1 00
Edwin Gaffney,	West Monroe,	"	"	1 00
James Montana,	"	"	"	1 00
John E. Lord,	"	"	"	1 00
George S. Petty,	"	"	"	1 00
William Shafer,	"	"	"	1 00
Rodney Petty,	"	"	"	1 00
William Pierce,	"	"	"	1 00
E. J. Pierce,	"	"	"	1 00
Frank Bell,	Brewerton,	"	"	1 00
Philip Bell,	"	"	"	1 00
Giles Wood,	"	"	"	1 00
Frank Klock,	"	"	"	1 00
Edward Meaney,	"	"	"	1 00
Henry Hopkins,	"	"	"	1 00
Lewis Patchen,	"	"	"	1 00
Frank Ladd,	"	"	"	1 00
Cherog Ladd,	"	"	"	1 00
C. Landers,	"	"	"	1 00
Harrison Landers,	"	"	"	1 00
Sheldon Baum,	"	"	"	1 00
J. McAllister, Jr.,	"	"	"	1 00
			Forward,	$98 00

SCHEDULE OF LICENSES.—CONTINUED.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$98 00
George L. Kathan,	Brewerton,	1 trap,	Oneida Lake,	1 00
E. E. Pierce,	"	"	"	1 00
William Miller, Jr.,	Germantown,	5 fyke,	Hudson River,	1 00
Ernest Olin,	Hudson,	3 "	"	1 00
Nelson Conine,	Catskill,	20 "	"	1 00
William Hallenbeck & Son,	Hudson,	20 "	"	1 00
John McVicar,	Cicero Centre,	1 trap,	Oneida Lake,	1 00
Richard Pallas,	"	"	"	1 00
Herman Pallas,	"	"	"	1 00
Edgar Johnston,	Constantia,	"	"	1 00
Nelson Van Antwerp,	"	"	"	1 00
James Andrews,	"	"	"	1 00
Daniel King,	"	"	"	1 00
L. J. McAllister,	West Monroe,	"	"	1 00
Frank Shaw,	"	"	"	1 00
Daniel Thomas,	Cicero,	"	"	1 00
Charles Smith,	"	"	"	1 00
H. R. Livingston,	Brewerton,	"	"	1 00
George A. Ladd,	"	"	"	1 00
Horatio S. Darling,	"	"	"	1 00
D. K. Winn,	Constantia,	"	"	1 00
Stephen Wilson,	Cicero,	"	"	1 00
Harrison Deyo,	Bridgeport,	"	"	1 00
Michael Burke,	Lewiston,	"	Niagara River,	5 00
James H. Boyd,	"	"	"	5 00
			Forward,	$131 00

SCHEDULE OF LICENSES.—CONTINUED.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$131 00
George Scriba,	Constantia,	1 trap,	Oneida Lake,	1 00
James Flarity,	"	"	"	1 00
George Lord,	"	"	"	1 00
Charles Lord,	West Monroe,	"	"	1 00
Edward Billington,	Bridgeport,	"	"	1 00
Clinton Smith,	West Monroe,	"	"	1 00
William Dobson,	Constantia,	"	"	1 00
E. E. Bouton,	Coughdenoy,	"	"	1 00
Burt M. Bellows,	"	"	"	1 00
N. M. Jennings,	Syracuse,	"	"	1 00
Frank France,	Cicero,	"	"	1 00
John Belknap,	Brewerton,	"	"	1 00
C. F. Miller,	"	"	"	1 00
John Gilford,	"	"	"	1 00
Watson Shafer,	"	"	"	1 00
George Wing,	"	"	"	1 00
John Hopkins,	"	"	"	1 00
Charles Lepinsky,	Cigarville,	"	"	1 00
Lamont Barney,	Henderson,	1 gill,	Lake Ontario,	1 00
James Hourahan,	Greenbush,	12 fyke,	Hudson River,	1 00
Charles W. Lynch,	Brewerton,	1 trap,	Oneida Lake,	1 00
W. A. Martin,	"	"	"	1 00
A. Dickson,	"	"	"	1 00
Albert Pickins,	"	"	"	1 00
Lester Pickins,	Cicero,	"	"	1 00
			Forward,	$156 00

SCHEDULE OF LICENSES.—CONTINUED.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$156 00
Ervin Weller,	Brewerton,	1 trap,	Oneida Lake,	1 00
S. D. Slocum,	West Monroe,	"	"	1 00
J. W. Carter,	Constantia,	"	"	1 00
Truman Johnson,	Cigarville,	"	"	1 00
Theodore Rushy,	West Monroe,	"	"	1 00
Dell Phillips,	"	"	"	1 00
Marshall Plum,	Brewerton,	"	"	1 00
S. S. Masten,	Pleasant Valley,	1 gill,	Wappinger Creek,	1 00
D. C. Sumner,	Brewerton,	1 trap,	Oneida Lake,	1 00
S. H. Orman,	"	"	"	1 00
James Sweeney,	"	"	"	1 00
George Plumer,	"	"	"	1 00
M. L. Hoyt,	Central Square,	"	"	1 00
Arthur Cashdollar,	Tivoli,	15 fyke,	Hudson River,	1 00
Reuben Cross,	Lakeport,	1 trap,	Oneida Lake,	1 00
Charles Cass,	"	"	"	1 00
Orris O. Luff,	Henderson Harbor,	1 gill,	Lake Ontario,	1 00
C. Pierce,	Cicero,	1 trap,	Oneida Lake,	1 00
Charles Fiehert,	West Monroe,	"	"	1 00
Edward Fracier,	Henderson,	ciscoe,	Lake Ontario,	1 00
Herbert Fredenburg,	Catskill,	fyke,	Hudson River,	1 00
Eli Maston, Jr.,	Pleasant Valley,	1 gill,	Wappinger Creek,	1 00
Reuben Johnson,	West Monroe,	1 trap,	Oneida Lake,	No fee.
Daniel Killum,	Brewerton,	"	"	1 00
L. F. Schillinger,	West Monroe,	"	"	1 00
			Forward,	$180 00

SCHEDULE OF LICENSES.—CONTINUED.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$180 00
Charles Neemon,	Cohoes,	4 gill,	Hudson River,	1 00
C. L. Kramer,	Niagara Falls,	1 trap,	Niagara River,	5 00
F. McAllister,	Brewerton,	"	Oneida Lake,	1 00
George T. Record,	Dover Plains,	1 net,	Ten-Mile River,	1 00
James Clark,	Poughkeepsie,	1 gill,	Wappinger Creek,	1 00
John Kinnecutt,	Albany,	20 fyke,	Hudson River,	1 00
Mary L. Best,	Hudson,	"	"	1 00
Rensler Proper,	Linlithgo,	"	"	1 00
Water Commissioners,	Newburg,	net,	Lake or Reservoir,	No fee
George Drumgold,	North Germantown,	15 fyke,	Hudson River,	1 00
Ephraim Snyder,	"	17 "	"	1 00
John Locknell,	"	15 "	"	1 00
Eli Masten, Jr.,	Pleasant Valley,	1 gill,	Wappinger Creek,	1 00
John W. Evans,	Poughkeepsie,	"	"	1 00
Charles Burdick,	Pleasant Valley,	"	"	1 00
John B. Myers,	Buffalo,	20 sturgeon,	Lake Erie,	1 00
S. Rockefeller,	Germantown,	3 fyke,	Hudson River,	1 00
Timothy Wilson, Jr.,	Wilson,	2 gill,	Lake Ontario,	1 00
S. S. Watson,	Pleasant Valley,	1 "	Wappinger Creek,	1 00
Samuel Sheffer,	North Germantown,	20 fyke,	Hudson River,	1 00
John Pilkinton,	Wilson,	1 gill,	Lake Ontario,	1 00
John B. Myers,	Buffalo,	"	Lake Erie,	1 00
T. B. Reichert,	Poughkeepsie,	"	Wappinger Creek,	1 00
James Hourahan,	East Albany,	12 fyke,	Hudson River,	1 00
McMaster & Larson,	Kendall,	1 gill,	Lake Ontario,	4 00
			Forward,	$211 00

SCHEDULE OF LICENSES.—Continued.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$211 00
Wesley Fredenburgh,	Catskill,	15 fyke,	Hudson River,	1 00
W. H. Brandow,	"	"	"	1 00
Levi Ham,	"	10 "	"	1 00
Joseph D. Williams,	Poughkeepsie,	1 gill,	Wappinger Creek,	1 00
D. M. Wheeler,	Wilson,	"	Lake Ontario,	1 00
R. Taylor & Son,	Point Breeze,	1 sturgeon,	"	1 00
George Wright, Jr.,	Hilton,	1 gill,	"	1 00
Joseph Square,	Buffalo,	1 "	Lake Erie,	1 00
B. S. Martin,	Angola,	2 "	"	2 00
E. A. Hoag,	Dover Furnace,	1 "	Ten-Mile River,	1 00
Peter F. Bronk,	New Baltimore,	20 fyke,	Hudson River,	1 00
James H. Ham,	Hudson,	20 "	"	1 00
Horace Kelley,	Tivoli,	3 "	"	1 00
D. D. Beckwith,	Angola,	1 seine,	Lake Erie,	1 00
William Van Steenburgh,	Watervliet,	8 fyke,	Hudson River,	1 00
Clarence English,	Tivoli,	6 "	"	1 00
George Fitzpatrick,	Stuyvesant,	20 "	"	1 00
N. B. Palmer,	"	5 "	"	1 00
Jacob B. Lewis,	Catskill,	20 "	"	1 00
Charles Martekopsky,	Albany,	24 "	"	1 00
William Straker,	Buffalo,	1 gill,	Lake Erie,	1 00
Anton Potosi,	"	"	"	1 00
William T. Race,	Hudson,	20 fyke,	Hudson River,	1 00
Matthew Holscher,	Castleton,	30 "	"	1 00
"	"	2 seine,	"	1 00
			Forward,	$237 00

SCHEDULE OF LICENSES.—Continued.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$237 00
Alvin Calkins,	Stuyvesant,	2 gill,	Hudson River,	1 00
William Firebran,	Buffalo,	1 "	Lake Erie,	1 00
William Miller, Jr.,	North Germantown,	10 fyke,	Hudson River,	1 00
Charles Trautwein,	Buffalo,	3 gill,	Lake Erie,	3 00
James King,	Evans,	1 "	"	1 00
J. W. Page,	Derby,	"	"	1 00
J. B. Page,	"	"	"	1 00
James MacGregor,	Evans,	"	"	1 00
Thomas A. Huddy,	Buffalo,	1 sturgeon,	"	1 00
Frank L. Powley,	Youngstown,	2 gill,	Lake Ontario,	2 00
Henry Coon,	Hudson,	5 fyke,	Hudson River,	1 00
Coons & Saulspaugh,	"	20 "	"	1 00
Charles Lynch,	Tivoli,	15 "	"	1 00
James Bowman,	Troy,	1 seine,	"	1 00
Owen McLaughlin,	"	1 scap,	"	1 00
B. S. Martin,	Angola,	2 trap,	Lake Erie,	2 00
John Lynk,	Tivoli,	15 fyke,	Hudson River,	1 00
J. W. Cummings,	Catskill,	2 "	"	1 00
William Boss,	Buffalo,	2 "	Lake Erie,	2 00
James MacGregor,	Evans,	1 trap,	"	1 00
A. Van Steenburg,	Youngstown,	1 gill,	Lake Ontario,	1 00
J. B. Lewis,	Castleton,	2 seine,	Hudson River,	1 00
Thomas Hickey,	Watervliet,	fyke,	"	1 00
C. J. Alexander,	Dunkirk,	1 gill,	Lake Erie,	1 00
J. H. Waters,	Schodack Landing,	3 fyke,	Hudson River,	1 00
			Forward,	$267 00

SCHEDULE OF LICENSES.—Continued.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$267 00
Timothy Sheehan,	Stuyvesant,	1 seine,	Hudson River,	1 00
James B. Lynch,	Coxsackie,	"	"	1 00
Emery Tryon,	Lake View,	1 fyke,	Lake Erie,	1 00
"	"	1 gill,	"	1 00
William Wilson,	Wilson,	2 gill,	Lake Ontario,	2 00
V. R. Riddle,	Albany,	fyke,	Hudson River,	1 00
Jacob M. Askins,	Troy,	1 scap,	"	1 00
Lewis J. Elting,	Grandale,	fyke,	"	1 00
Frederick Ducat,	Watervliet,	1 seine,	"	1 00
John H. Hill,	West Camp,	20 fyke,	"	1 00
S. G. Melius,	Saugerties,	15 "	"	1 00
William J. Peckover,	North Evans,	1 gill,	"	1 00
John Denne,	Watervliet,	20 fyke,	"	1 00
Augustus R. Briggs,	Coeymans,	1 seine,	"	1 00
William Stinson,	Saugerties,	1 shad,	"	1 00
Thomas F. Brennan,	Athens,	1 fyke,	"	1 00
John H. O'Brien,	Buffalo,	1 gill,	Lake Erie,	1 00
James King,	Evans,	1 trap,	"	1 00
E. Albertson,	Stuyvesant,	1 seine,	Hudson River,	1 00
William Appleton,	Greenbush,	fyke,	"	1 00
William Stevens,	Troy,	1 seine,	"	1 00
Cornelius Best,	Coeymans,	18 fyke,	"	1 00
Reuben Brown,	Troy,	1 seine,	"	1 00
A. Staniel,	Greenbush,	"	"	1 00
John Wagner,	Youngstown,	2 gill,	Lake Ontario,	2 00
			Forward,	$294 00

SCHEDULE OF LICENSES.—Continued.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$294 00
Frank Smith,	Buffalo,	1 sturgeon,	Lake Erie,	1 00
Mary L. Best,	Hudson,	1 seine,	Hudson River,	1 00
Henry Striland,	Coeymans,	5 fyke,	"	1 00
Edward Waters,	North Germantown,	10 "	"	1 00
Edward Brooks,	Greenbush,	1 gill,	"	1 00
George A. Wicks,	"	1 seine,	"	1 00
Thomas Montgomery,	Catskill,	1 gill,	"	1 00
F. M. Strabel,	Buffalo,	2 "	Lake Erie,	2 00
Lewis Hanson,	Angola,	1 sturgeon,	"	1 00
John McConville,	Albany,	2 fyke,	Hudson River,	1 00
Peter Gregory,	Bath,	1 seine,	"	1 00
T. F. Clark,	Watervliet,	1 "	"	1 00
J. M. Van Loon,	Coxsackie,	2 "	"	1 00
William Fohnsbee,	Castleton,	1 "	"	1 00
George E. Fohnsbee,	"	4 fyke,	"	1 00
Willard Fohnsbee,	"	7 "	"	1 00
L. F. Decker,	Catskill Station,	2 "	"	1 00
James H. Jennings,	"	2 drift,	"	1 00
S. Overbaugh,	West Camp,	5 gill,	"	1 00
H. Southwick,	Schodack Landing,	1 seine,	"	1 00
Lester Muller,	North Germantown,	2 shad,	"	1 00
John A. Robinson,	Green Island,	1 seine,	"	1 00
Nicholas Pauley,	Albany,	20 fyke,	"	1 00
Nathan M. Rose,	Athens,	7 "	"	1 00
Charles Saulspaugh,	Coxsackie,	1 gill,	"	1 00
			Forward,	$320 00

SCHEDULE OF LICENSES.—CONTINUED.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$320 00
Clarence Jackwacy,	Fredonia,	1 gill,	Lake Erie,	1 00
William S. Baird,	Pultneyville,	1 sturgeon,	Lake Ontario,	1 00
Frank Pond,	Athol Springs,	1 gill,	Lake Erie,	1 00
William Swart,	Malden,	2 drift,	Hudson River,	1 00
W. H. Swart,	"	"	"	1 00
Isaac Lucas,	West Camp,	"	"	1 00
George Davis,	West Seneca,	1 gill,	Lake Erie,	1 00
Peter Coons,	Glenmount,	1 seine,	Hudson River,	1 00
Jesse Cole,	Catskill Station,	2 drift,	"	1 00
John Spellman,	"	2 gill,	"	1 00
John Scharff,	Wemple Station,	1 seine,	"	1 00
George Denne,	Watervliet,	"	"	1 00
George W. Turpening,	Malden,	2 drift,	"	1 00
David Overbaugh,	"	"	"	1 00
James D. Rightmyer,	"	"	"	1 00
George Flicker,	"	"	"	1 00
Isaac Zeilman,	"	"	"	1 00
Willett M. Roos,	Walkill,	1 fyke,	Wallkill Creek,	1 00
John H. Dyer,	Watervliet,	1 scap,	Hudson River,	1 00
"	"	7 fyke,	"	1 00
Frederick Neaybour,	Dunkirk,	1 gill,	Lake Erie,	1 00
Peter Anderson,	Angola,	"	"	1 00
George Thompson,	Buffalo,	1 sturgeon,	"	1 00
George Wagner,	Youngstown,	2 gill,	Lake Ontario,	2 00
John S. Wilson,	Wilson,	1 "	"	1 00
			Forward,	$346 00

SCHEDULE OF LICENSES.—CONTINUED.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$346 00
John Pilkinton,	Wilson,	1 gill,	Lake Ontario,	1 00
John Kehver,	Glenmont,	2 seine,	Hudson River,	1 00
Oscar Schultes,	Cheviot,	3 gill,	"	1 00
Charles J. Rightmyer,	Malden,	2 drift,	"	1 00
Patrick McDonough,	Buffalo,	1 gill,	Lake Erie,	1 00
Robert Hoot,	Point Breeze,	2 sturgeon,	Lake Ontario,	2 00
John Locknell,	North Germantown,	3 gill,	Hudson River,	1 00
Samuel G. Melius,	Saugerties,	1 shad,	"	1 00
James K. Rightmyer,	Malden,	2 drift,	"	1 00
Ovid M. Mather,	Greenbush,	1 gill,	"	1 00
Wesley Ham,	Linlithgo,	3 "	"	1 00
E. M. & W. W. Hover,	"	2 "	"	1 00
Henry Askins,	Troy,	1 seine,	"	1 00
John J. Pindar,	Catskill,	1 "	"	1 00
George Davis,	West Seneca,	1 sturgeon,	Lake Erie,	1 00
A. E. Davis,	"	1 "	"	1 00
Matthew Kennedy,	Hudson,	5 seine,	Hudson River,	1 00
David Hallenbeck,	Livingston,	2 drift,	"	1 00
Charles H. Turpening,	Malden,	"	"	1 00
Benjamin Overbaugh,	"	"	"	1 00
Charles H. Wheeler,	Wilson,	1 gill,	Lake Ontario,	1 00
Samuel Sheffer,	North Germantown,	4 drift,	Hudson River,	1 00
Clarence English,	Tivoli,	2 "	"	1 00
H. L. Moose,	West Camp,	4 gill,	"	1 00
E. Briggs,	Coxsackie,	"	"	1 00
			Forward,	$372 00

SCHEDULE OF LICENSES.—Continued.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$372 00
Russell Overbaugh,	Malden,	2 shad,	Hudson River,	1 00
Herbert Hover,	"	"	"	1 00
John Duffy,	Linlithgo,	1 drift,	"	1 00
Walter Flicker,	Malden,	1 shad,	"	1 00
C. H. Slingerland,	Coeymans,	1 seine,	"	1 00
Thomas Craig,	Green Island,	2 drift,	"	1 00
Haskell Dedrick,	Coxsackie,	1 seine,	"	1 00
Sheldon O'Bryon,	Malden,	3 drift,	"	1 00
Wilcox & Henderson,	Columbiaville,	12 fyke,	"	1 00
C. E. Ackerman,	Wilson,	1 gill,	Lake Ontario,	1 00
F. Hehrig & Co.,	Dunkirk,	1 "	Lake Erie,	1 00
John Desmond,	"	1 "	"	1 00
F. W. Ingram,	"	1 "	"	1 00
William Barrow,	"	1 "	"	1 00
Silas Noble,	Olcott,	4 "	Lake Ontario,	4 00
Edward B. Horton,	Henderson Harbor,	1 "	"	1 00
McClellan & Dennee,	Cape Vincent,	1 "	"	1 00
A. A. Bugbee,	Olcott,	3 "	"	3 00
Charles H. Hover & Co.,	North Germantown,	1 seine,	Hudson River,	1 00
Charles Austin,	Greenport,	"	"	1 00
C. H. Lasher,	North Germantown,	2 gill,	"	1 00
Patrick Bodkins,	Buffalo,	1 sturgeon,	Lake Erie,	1 00
Ephraim Snyder,	North Germantown,	3 drift,	Hudson River,	1 00
John McIntyre,	Irving,	1 gill,	Lake Erie,	1 00
Snyder & Sheffer Co.,	North Germantown,	4 "	Hudson River,	1 00
			Forward,	$402 00

SCHEDULE OF LICENSES.—CONTINUED.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$402 00
George R. Lasher,	Greenbush,	1 gill,	Hudson River,	1 00
H. Odell,	Coxsackie,	1 fyke,	"	1 00
William J. Higgins,	Dunkirk,	1 seine,	Lake Erie,	1 00
M. F. Dunn,	Buffalo,	1 sturgeon,	"	1 00
Conrad Krutz,	"	"	"	1 00
Hiram E. Brown,	Watervliet,	1 seine,	Hudson River,	1 00
T. R. Platner,	Linlithgo,	2 gill,	"	1 00
Conine Bros.,	Catskill,	2 shad,	"	1 00
John Beck,	Buffalo,	1 sturgeon,	Lake Erie,	1 00
John Beck,	"	1 gill,	"	1 00
John H. Fellen,	Linlithgo,	2 "	Hudson River,	1 00
Charles Rockefeller,	Cheviot,	2 "	"	1 00
E. R. DeWitt,	"	2 "	"	1 00
Wilson Snyder,	North Germantown,	2 drift,	"	1 00
Frederick Moore,	"	2 "	"	1 00
Herbert Houn,	Germantown,	1 "	"	1 00
Charles Van Dusen,	Hudson,	1 shad,	"	1 00
James Burnett,	Saugerties,	1 drift,	"	1 00
Charles F. Root,	Cooperstown,	1 seine,	Otsego Lake,	1 00
Burt Hibbard,	"	"	"	1 00
S. S. Phillips,	"	"	"	1 00
E. F. Farquarson,	"	"	"	1 00
L. J. Parshall,	"	"	"	1 00
M. Dewitt Eckler,	"	"	"	1 00
L. D. Benton,	"	"	"	1 00
			Forward,	$427 00

SCHEDULE OF LICENSES.—Continued.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$427 00
Frederick E. Hopkins,	Cooperstown,	1 seine,	Otsego Lake,	1 00
Jeremiah Parish,	"	"	"	1 00
Pierce & Myers,	"	"	"	1 00
Wood & Wood,	"	"	"	1 00
V. N. P. Cooper,	"	"	"	1 00
Frederick House,	"	"	"	1 00
G. W. Thayer,	Springfield Centre,	"	"	1 00
W. A. Brockway,	"	"	"	1 00
W. J. Thayer,	"	"	"	1 00
K. E. White,	"	"	"	1 00
Stuart Ellsworth,	"	"	"	1 00
Smith & Snyder,	"	"	"	1 00
Duncan L. Rathbone,	East Springfield,	"	"	1 00
Joseph Peaslee,	"	"	"	1 00
John Oathout,	Watervliet,	"	Hudson River,	1 00
Frank Leek,	Athens,	2 seine,	"	1 00
A. Simmons,	Malden,	2 drift,	"	1 00
Hiram Knol,	Schodack Landing,	1 seine,	"	1 00
William H. Coon, Jr.,	Germantown,	2 drift,	"	1 00
H. J. McEwan,	Evans,	1 sturgeon,	Lake Erie,	1 00
Holland & Bromley,	Angola,	"	"	1 00
Frank Bocard,	Buffalo,	"	"	1 00
Meed & Meed,	East Worcester,	1 seine,	Otsego Lake,	1 00
Hall & Hall,	"	"	"	1 00
George Newkirk,	Cooperstown,	"	"	1 00
			Forward,	$452 00

SCHEDULE OF LICENSES.—CONTINUED.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$452 00
Olin P. Wood,	Springfield Centre,	1 seine,	Otsego Lake,	1 00
Emmet Armstrong,	Woodville,	1 "	Lake Ontario,	1 00
Roger Donnelancko,	Buffalo,	1 "	Lake Erie,	1 00
Hibbard & Jackson,	Cooperstown,	1 "	Otsego Lake,	1 00
Miller & Shultis,	Cheviot,	2 "	Hudson River,	1 00
Harry E. Turpening,	Malden,	2 drift,	"	1 00
Garry Wallace,	Hudson,	1 seine,	"	1 00
Emanuel Joseph,	Buffalo,	1 gill,	Lake Erie,	1 00
Frank Wutz,	"	2 "	"	2 00
Milan Culp,	"	1 "	"	1 00
Herman Myers,	"	1 "	"	1 00
Clayton G. Huson,	Blasdell,	1 trap,	"	1 00
Joseph Sweet,	"	1 sturgeon,	"	1 00
William Sullivan,	Westville,	1 seine,	Otsego Lake,	1 00
G. H. Farquharson,	Cooperstown,	"	"	1 00
J. J. Miniger,	Westfield,	1 trap,	Lake Erie,	1 00
"	"	1 gill,	"	1 00
R. B. Scheffer,	Catskill,	3 "	Hudson River,	1 00
S. C. Cross,	Tivoli,	1 "	"	1 00
J. S. Coons,	North Germantown,	3 drift,	"	1 00
Alonzo Shultis,	Saugerties,	1 "	"	1 00
Charles Fredenburgh,	Catskill,	3 "	"	1 00
George Fredenburgh,	"	3 "	"	1 00
Hiram Cullett,	Troy,	1 dip,	"	1 00
Daniel Kelley,	Buffalo,	1 gill,	Lake Erie,	1 00
			Forward,	$478 00

SCHEDULE OF LICENSES.—CONTINUED.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$478 00
John O. Keefe,	Buffalo,	1 gill,	Lake Erie,	1 00
Albert Olsen,	Athol Springs,	"	"	1 00
John Latten,	Irving,	"	"	1 00
Charles H. Jones,	Marshville,	1 seine,	Otsego Lake,	1 00
Lee Canfield,	Westfield,	1 trap,	Lake Erie,	1 00
E. S. Miniger,	"	1 gill,	"	1 00
W. H. Miniger,	"	1 trap,	"	1 00
Wilbur Fitch,	Wolcott,	1 sturgeon,	Lake Ontario,	1 00
Byron A. Southwick,	Woodville,	"	"	1 00
L. S. Flint,	Sprout Brook,	1 seine,	Otsego Lake,	1 00
George Holcomb,	Cooperstown,	"	"	1 00
Menzo Miller,	"	"	"	1 00
John H. Keough,	"	"	"	1 00
A. H. Gaylay,	"	"	"	1 00
Short & Eldred,	"	"	"	1 00
Andrews & Wheeler,	"	"	"	1 00
Alfred Hull,	Cherry Valley,	"	"	1 00
William Gardner,	Smith's Landing,	1 gill,	Hudson River,	1 00
T. R. Best,	Linlithgo,	3 "	"	1 00
Thomas McKenna,	Watervliet,	1 seine,	"	1 00
F. Schmitt,	Buffalo,	2 fyke,	Lake Erie,	2 00
George Dernbrack,	"	1 sturgeon,	"	1 00
G. W. Drumgold,	North Germantown,	2 drift,	Hudson River,	1 00
C. Best,	Stuyvesant,	2 seine,	"	1 00
William Miller, Jr.,	Germantown,	4 drift,	"	1 00
			Forward,	$504 00

SCHEDULE OF LICENSES.—CONTINUED.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$504 00
Harry J. Ray,	Hudson,	2 drift,	Hudson River,	1 00
John Newman,	Smith's Landing,	1 shad,	"	1 00
J. J. Carroll,	Troy,	1 dip,	"	1 00
Charles H. Balford,	Buffalo,	1 sturgeon,	Lake Erie,	1 00
John Friis,	"	"	"	1 00
George K. Harmon,	"	1 gill,	"	1 00
George H. Pierce,	Springfield Centre	1 seine,	Otsego Lake,	1 00
Ansel Westcott,	Yates,	1 gill,	Lake Ontario,	1 00
R. & G. Phillips,	Cape Vincent,	"	"	1 00
Norton & Hogan,	Cooperstown,	1 seine,	Otsego Lake,	1 00
J. W. Bowmaker,	"	"	"	1 00
A. Trautwein,	Buffalo,	1 gill,	Lake Erie,	1 00
Henry Schemerhorn,	North Germantown,	2 drift,	Hudson River,	1 00
F. Holcourt,	Cooperstown,	1 seine,	Otsego Lake,	1 00
Silas Kinskern,	"	"	"	1 00
L. E. Saxton,	"	"	"	1 00
James A. Elting,	Hudson,	3 gill,	Hudson River,	1 00
T. P. Gardner,	Catskill,	1 "	"	1 00
Albert Castle,	New Baltimore,	1 seine,	"	1 00
J. D. Lloyd,	Westfield,	2 trap,	Lake Erie,	2 00
W. L. Ackerman,	Wilson,	1 gill,	Lake Ontario,	1 00
Cook & Van Horne,	Springfield Center,	1 seine,	Otsego Lake,	1 00
John K. Klee,	West Seneca,	1 sturgeon,	Lake Erie,	1 00
Abram Stewart,	Lake View,	1 gill,	"	1 00
Taylor & Webster,	Point Breeze,	3 sturgeon,	Lake Ontario,	3 00
			Forward,	$532 00

SCHEDULE OF LICENSES.—CONTINUED.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$532 00
Samuel G. Melius,	Saugerties,	4 gill,	Hudson River,	1 00
Howard Sullivan,	Westville,	1 seine,	Otsego Lake,	1 00
F. L. Trinder,	Lake View,	1 gill,	Lake Erie,	1 00
William Brown,	Buffalo,	"	"	1 00
Harry Boyd,	Dunkirk,	"	"	1 00
Delevan House,	Cooperstown,	1 seine,	Otsego Lake,	1 00
W. H. Smith,	"	"	"	1 00
Van Dusen & Campbell,	"	"	"	1 00
James Zeilman,	Malden,	"	Hudson River,	1 00
Willie Zeilman,	"	"	"	1 00
John H. Saulspaugh,	Cheviot,	3 seine,	"	1 00
Frank Found,	Athol Springs,	1 trap,	Lake Erie,	1 00
Albert Oleson,	"	"	"	1 00
Harry Boyd,	Dunkirk,	1 gill,	"	1 00
Frank Ottman,	East Springfield,	1 seine,	Otsego Lake,	1 00
Cl. Wyckhoff,	"	"	"	1 00
Frank Cooper,	Cooperstown,	"	"	1 00
Roger Donnelancko,	Buffalo,	1 gill,	Lake Erie,	1 00
George Heilbert,	"	"	"	1 00
Clarence Jackway,	Dunkirk,	1 trap,	"	2 00
George Stadehymer,	Buffalo,	1 gill,	"	1 00
James W. Fuller,	Downsville,	1 seine,	Delaware River,	1 00
Charles R. Knapp,	Union Grove,	"	"	1 00
David Steinson,	Saugerties,	1 shad,	Hudson River,	1 00
Louis W. Cashdollar,	Tivoli,	1 herring,	"	1 00
			Forward,	$558 00

SCHEDULE OF LICENSES.—CONTINUED.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$558 00
Thomas Smith,	Buffalo,	1 gill,	Lake Erie,	1 00
Wallace Whitread,	Derby,	"	"	1 00
Gibson & Wibber,	Angola,	1 sturgeon,	"	1 00
Remus Swift,	Blasdell,	1 gill,	"	1 00
Alfred Skinner,	"	"	"	1 00
H. A. Freling,	Westfield,	2 gill,	"	2 00
"	"	8 trap,	"	8 00
Henry Mills,	"	1 gill,	"	1 00
Anthony Gottschalk,	"	"	"	1 00
Henry Oaks,	"	"	"	1 00
Westfield Fish Co.,	"	"	"	1 00
A. P. Sharpsteen,	Barker,	2 gill,	Lake Ontario,	2 00
Isaac H. Sharpe,	Walcott,	1 "	"	1 00
Martin A. White,	Delhi,	1 seine,	Delaware River,	1 00
Augustus Clark,	Watervliet,	"	Hudson River,	1 00
Smith & Firoe,	Tivoli,	3 seine,	"	1 00
James Zeilman, Jr.,	Malden,	1 gill,	"	1 00
William Ennis,	Saugerties,	1 shad,	"	1 00
Alpheus Simmons,	Tivoli,	2 sturgeon,	"	1 00
Walter Mann,	Coxsackie Station,	1 seine,	"	1 00
William L. Atwater,	Barker,	1 gill,	Lake Ontario,	1 00
Charles C. Lockwood,	Olcott,	"	"	1 00
M. Lennert,	Buffalo,	1 sturgeon,	Lake Erie,	1 00
M. Krosinski,	"	1 gill,	"	1 00
Antoni Wolski,	"	"	"	1 00
			Forward,	$592 00

SCHEDULE OF LICENSES.—Continued.

Licensee	Residence	Kind of Net	Water	Fee Paid
			Brought forward,	$592 00
John Ryan,	Buffalo,	1 gill,	Lake Erie,	1 00
George Ott,	"	1 sturgeon,	"	1 00
John Sylvia,	"	1 gill,	"	1 00
George P. Ratel,	"	1 sturgeon,	"	1 00
Harry Miller,	Cheviot,	2 scap,	Hudson River,	1 00
Hiram Cullett,	Troy,	1 seine,	"	1 00
George S. Ludington,	Catskill,	2 drift,	"	1 00
J. F. Brown,	Smith's Landing,	2 gill,	"	1 00
Frederick Solomon,	Cedar Hills,	1 seine,	"	1 00
Ernest Olen,	Hudson,	1 drift,	"	1 00
John H. Plass,	Catskill Station,	2 gill,	"	1 00
William Hosford,	Athens,	1 "	"	1 00
Thomas A. Hoffman,	Tivoli,	1 drift,	"	1 00
William Seebode,	"	1 herring,	"	1 00
John Lynk,	"	2 sturgeon,	"	1 00
Frank Lynch,	"	"	"	1 00
F. W. Sherman,	Buffalo,	1 gill,	Lake Erie,	1 00
H. D. Face,	Evans,	1 sturgeon,	"	1 00
Hiram Betts,	Downsville,	1 seine,	Delaware River,	1 00
Phillips Shannon,	Watervliet,	1 scap,	Hudson River,	1 00
Frederick Mosley,	New Baltimore,	1 drift,	"	1 00
Isaac A. Shover,	Watervliet,	1 dip,	"	1 00
Charles Lynch,	Tivoli,	2 sturgeon,	"	1 00
Theodore Brandow,	Hudson,	2 gill,	"	1 00
George Loomis,	Point Breeze,	2 sturgeon,	Lake Ontario,	2 00
			Forward,	$618 00

SCHEDULE OF LICENSES.—Continued.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$618 00
William H. Comstock,	Point Breeze,	2 sturgeon,	Lake Ontario,	2 00
"	"	2 gill,	"	2 00
J. J. Burns,	Buffalo,	1 "	Lake Erie,	1 00
Alexander D. Lathrop,	Stockport,	1 drift,	Hudson River,	1 00
Henry Jennings,	Catskill Station,	2 "	"	1 00
W. C. Saulspaugh,	North Germantown,	1 "	"	1 00
Chris. Schlunker,	Smith's Landing,	2 gill,	"	1 00
E. Sweer,	Dunkirk,	1 "	Lake Erie,	1 00
Tony Smith,	West Seneca,	1 "	"	1 00
George W. English,	Dunkirk,	1 "	"	1 00
Frederick Smith,	"	1 "	"	1 00
William Cottrell,	Forest Lawn,	1 "	Lake Ontario,	1 00
Ezra Rightmyer,	Malden,	1 shad,	Hudson River,	1 00
William H. Traver,	Stockport Centre,	1 herring,	"	1 00
C. Wolver,	Malden,	2 drift,	"	1 00
George Smith,	Stuyvesant,	1 seine,	"	1 00
Edward Sheffer,	Catskill,	1 herring,	"	1 00
Matthew C. Cunn,	West Camp,	1 shad,	"	1 00
Samuel Melius,	Saugerties,	2 gill,	"	1 00
Jacob Saulspaugh,	Linlithgo,	"	"	1 00
E. L. Morgan,	West Seneca,	1 sturgeon,	Lake Erie,	1 00
Lewis Gann,	"	1 seine,	"	1 00
Reuben Case,	Portland,	3 trap,	"	3 00
Reuben Proper,	Linlithgo,	4 gill,	Hudson River,	1 00
L. W. Cashdollar,	Tivoli,	1 herring,	"	1 00
			Forward,	$647 00

SCHEDULE OF LICENSES.—CONTINUED.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$647 00
W. H. Brandow,	Catskill,	2 drift,	Hudson River,	1 00
Thomas Boyd,	Colonie,	1 dip,	"	1 00
Hugo E. Finski,	Silver Creek,	1 sturgeon,	Lake Ontario,	1 00
Mulford & Von Voorhis,	Kendall,	2 gill,	"	2 00
G. H. Tifft,	Westfield,	1 trap,	Lake Erie,	1 00
E. A. Bartholomew,	Evans Centre,	1 gill,	"	1 00
Louis Evans,	Buffalo,	1 sturgeon,	"	1 00
Phillip P. Smith,	Tivoli,	2 scap,	Hudson River,	1 00
Henry Fuller,	Linlithgo,	2 gill,	"	1 00
Wood & Ackert,	Springfield Centre,	1 seine,	Otsego Lake,	1 00
W. H. Kilmer,	Castleton,	2 gill,	Hudson River,	1 00
B. E. Ingersol,	Oswego,	1 "	Lake Ontario,	1 00
Myron Parsons, Jr.,	Forest Lawn,	1 "	"	1 00
Robert Hoot,	Point Breeze,	1 whitefish,	"	1 00
Henry Centeur,	Dunkirk,	1 gill,	Lake Erie,	1 00
W. H. Fuller,	"	2 "	"	1 00
John Edwards,	Lake View,	1 "	"	1 00
John Lorenz,	"	1 trap,	"	1 00
Thomas H. Whitbeck,	Stuyvesant,	10 fyke,	Hudson River,	1 00
J. J. Pindar,	Catskill,	5 sturgeon,	"	1 00
John Oberst,	Buffalo,	1 gill,	Lake Erie,	1 00
William Bird,	"	1 "	"	1 00
George Sheffer,	Linlithgo,	2 shad,	Hudson River,	1 00
John H. Hill,	West Camp,	1 sturgeon,	"	1 00
Eugene Shafer,	Olcott,	1 gill,	Lake Ontario,	1 00
			Forward,	$673 00

SCHEDULE OF LICENSES.—CONTINUED.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$673 00
Edwin Alvers,	Wilson,	1 gill,	Lake Ontario,	1 00
Correll & Elmer,	North Huron,	3 "	"	3 00
Albert Hall,	Yates Center,	1 whitefish,	"	1 00
Charles H. Correll,	Wolcott,	1 sturgeon,	"	1 00
Baker Fishing Co.,	Dunkirk,	1 gill,	Lake Erie,	1 00
Oscar Shultes,	Cheviot,	2 sturgeon,	Hudson River,	1 00
William H. Grace,	Furnaceville,	1 "	Lake Ontario,	1 00
A. Kleinhaus,	Charlotte,	2 gill,	"	2 00
Herman Myers,	Buffalo,	1 trap,	Lake Erie,	1 00
Peter Coit,	"	1 sturgeon,	"	1 00
Evert Hotaling,	Springfield Centre,	1 seine,	Otsego Lake,	1 00
H. G. Gould,	"	"	"	1 00
J. A. Barton,	Lake View,	1 trap,	Lake Erie,	1 00
Emery Tryon,	"	3 "	"	3 00
H. A. Surface,	Ithaca,	1 "	Cayuga Lake,	No fee.
George Durnbrack,	Buffalo,	1 "	Lake Erie,	1 00
"	"	1 gill,	"	1 00
Feller & Merrill,	Cooperstown,	1 seine,	Otsego Lake,	1 00
Sheldon & Wicks,	"	"	"	1 00
J. S. Defrate,	Springfield Centre,	"	"	1 00
F. M. Gray,	Cooperstown,	"	"	1 00
M. Little,	"	"	"	1 00
Herbert Wadderspoon,	"	"	"	1 00
Fisk & Hibbard,	"	"	"	1 00
Marvin & Daily,	Lockport,	1 gill,	Lake Ontario,	1 00
			Forward,	$702 00

SCHEDULE OF LICENSES.—CONTINUED.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$702 00
Samuel Parsons,	Forest Lawn,	1 gill,	Lake Ontario,	1 00
W. E. Beaty,	Mount Reed,	"	"	1 00
John Fitts,	Somerset,	"	"	1 00
John Schultz,	Albany,	20 fyke,	Hudson River,	1 00
B. Vanderwall,	"	3 "	"	1 00
Simon Rockefeller,	Germantown,	3 "	"	1 00
George N. Sheffer,	Linlithgo,	20 "	"	1 00
Binnermann & Wickham,	Somerset,	1 gill,	Lake Ontario,	1 00
Lester Miller,	North Germantown,	20 fyke,	Hudson River,	1 00
Frederick Barringer,	Hudson,	1 gill,	"	1 00
L. Lasher,	Tivoli,	2 fyke,	"	1 00
G. Temple,	Linlithgo,	20 fyke,	"	1 00
Alfred Sheffer,	"	20 "	"	1 00
Peter Gregory,	Bath,	12 "	"	1 00
George Flicker,	Malden,	20 "	"	1 00
M. Delavergne,	Hilton,	1 gill,	Lake Ontario,	1 00
Charles Rightmyer,	Malden,	20 fyke,	Hudson River,	1 00
A. J. Rosenburgh,	Coxsackie Station,	12 "	"	1 00
Oscar Shultes,	Cheviot,	20 "	"	1 00
James H. McGilfry,	Bath,	15 "	"	1 00
J. M. Van Loan,	Coxsackie,	10 "	"	1 00
Thomas Murphy,	Watervliet,	20 "	"	1 00
John Kehrer,	Glenmont,	15 "	"	1 00
J. H. Eaton,	Coxsackie Station,	1 "	"	1 00
Theodore Brandow,	Hudson,	20 "	"	1 00
			Forward,	$727 00

SCHEDULE OF LICENSES.—CONCLUDED.

LICENSEE	RESIDENCE	KIND OF NET	WATER	FEE PAID
			Brought forward,	$727 00
William Hallenbeck & Son,	Hudson,	20 fyke,	Hudson River,	1 00
L. W. Cashdollar,	Tivoli,	25 "	"	1 00
Henry Feller,	Linlithgo,	15 "	"	1 00
Jacob Sheffer,	North Germantown,	5 "	"	1 00
Theodore Terstsel,	Coxsackie,	8 "	"	1 00
Frank Thompson,	Kuckville,	2 gill,	Lake Ontario,	2 00
Frank Smith,	Kendall,	2 sturgeon,	"	2 00
John Kinnicutt,	Albany,	20 fyke,	Hudson River,	1 00
Samuel Melius,	Saugerties,	20 "	"	1 00
Peter Race,	Hudson,	20 "	"	1 00
Barnet & Vorce,	Henderson Harbor,	1 gill,	Lake Ontario,	1 00
L. H. Wilcox,	Columbiaville,	1 fyke,	Hudson River,	1 00
Oscar Shultes, Jr.,	Cheviot,	20 "	"	1 00
Frank W. Fingar,	Madalin,	20 "	"	1 00
Charles Fredenburgh,	Catskill,	15 "	"	1 00
			Total,	$744 00

Summary of Net License Account.

Receipts.

1896.				
Oct.	1.	Balance in State Bank, Albany,	$138 00	
		Receipts for fiscal year ending Sept. 30, 1897, as per foregoing schedule,	744 00	
				$882 00

Disbursements.

1897.				
April	9.	James A Roberts, Comptroller,	$350 00	
June	9.	" "	350 00	
Oct.	1.	Balance in State Bank, Albany,	182 00	
				$882 00

Schedule of Fish Net Licenses Issued during the Year ending September 30, 1897.

Recapitulation.

Number issued for Lake Erie,	127
" " " Lake Ontario	59
" " " Oneida Lake,	160
" " " Otsego Lake,	61
" " " Hudson River,	110
" " " Delaware River,	4
" " " Wappinger Creek,	9
" " " Wallkill Creek,	1
" " " Niagara River,	3
" " " Ten Mile River,	2
" " " Cayuga Lake,	1
" " " Newburgh Water Reservoir,	1
Total number of licenses issued,	538
Total receipts for same,	$744.00

Rentals of Shellfish Lands.

Receipts.

1896.					
Oct. 6.	W. J. Ackerly,	rental,	$8 10		
	C. J. Scofield,	assignment,	50		
	George W. Sanbeg,	rental,	1 25		
	Mattinnecock Oyster Co.,	"	99 87		
13.	G. W. Robinson,	"	75		
	A. J. Joline,	"	75		
19.	Elizabeth Wright,	assignment,	50		
29.	W. W. Manee,	"	50		
	Beebe Bros.,	rental,	30 00		
	E. V. Merrill,	assignment,	50		
Nov. 2.	James Fischer,	"	50		
	David Becker,	rental,	4 30		
17.	N. Y. & L. I. Oyster Co.,	assignment,	50		
22.	W. J. Tillotson,	rental,	74 44		
1897.					
Jan. 4.	N. Y. & L. I. Oyster Co.,	"	120 00		
12.	W. J. Tillotson,	"	20 08		
Feb. 1.	C. H. Walters,	franchise,	260 00		
10.	Daniel Van Name,	rental,	5 00		
	N. Y. & L. I. Oyster Co.,	"	593 25		
	E. P. Doyle, former Secretary, on account of rentals collected by him,		133 02		
	Total receipts,			$1,353 81	

Disbursements.

1896.			
Oct. 8.	James A. Roberts, Comptroller,	$107 97	
Dec. 10.	" "	133 02	
1897.			
Jan. 13.	" "	593 25	
"	" "	234 49	
April 2.	" "	25 08	
Feb. 29.	" "	260 00	
	Total Disbursements,		$1,353 81

Miscellaneous Receipts.

1896.			
Nov. 27.	Received from E. P. Doyle, former Secretary, on account of Pleasant Valley construction and equipment as per chapter 358, Laws of 1894,	$2,772 40	
1897.			
Jan. 5.	Received from Commissioner C. H. Babcock, on account of sale of whitefish from Canandaigua Lake,	50 40	
July 8.	Received from James Annin, Jr., Superintendent of Hatcheries, on account of rebate from Express Company,	3 65	
	Total receipts,		$2,826 45

DISBURSEMENTS.

1896.			
Dec. 9.	James A. Roberts, Comptroller,	$2,772 40	
1897.			
Jan. 13.	" "	50 40	
July 19.	" "	3 65	
	Total disbursements,		$2,826 45

Report of the Chief Game Protector.

To the Commissioners of Fisheries, Game and Forests:

GENTLEMEN:—The work of the Protectors and Foresters during the year has been, for the most part, satisfactory. The number of prosecutions brought for violations of the laws for the protection of fish, game and forests, compares favorably with that of any previous year, and the percentage of convictions is equally favorable.

While the reports of the Protectors show that there is, in many of the districts, a growing sentiment in favor of the enforcement of the game laws, and that in some of them violations are extremely rare, there are also localities in which the sentiment of the people is so strong in opposition to the laws that violators are far too frequently acquitted by the jury or discharged by the justice under suspended sentence.

The following figures, which have been compiled by the Chief Protector, show the number and kind of illegal devices seized and destroyed by the Protectors for the fiscal year ending September 30, 1897:

Kind of Net.	No. of Nets.	Kind of Net.	No. of Nets.
Fyke,	607	Seines,	35
Trap,	193	Pound nets,	10
Gill,	303	Spears,	34
Squat,	40	Eel weirs,	13
Set lines,	610		
		Total,	1,845

The total value of the illegal devices destroyed was $19,634.

During the year there were successfully prosecuted 316 cases for violation of the Fisheries, Game and Forest Law, resulting in a recovery by the people of $10,728.78. Twenty-seven persons were convicted and sentenced to the penitentiary or county jail, while many others were convicted and sentence suspended. There were also many cases in which the evidence clearly showed a violation, but the sympathy of the jury for the defendant resulted in acquittal or disagreement.

The figures given above show excellent work on the part of the Protectors and is sufficient answer to the criticism of uninformed persons to the effect that the Protectors are incompetent and inefficient and, therefore, the laws for the protection of fish, game and forests are everywhere violated with impunity.

J. W. POND,

Chief Protector.

Report of the Superintendent of Hatcheries.

CALEDONIA, N. Y., *October* 1, 1897.

To the Commissioners of Fisheries, Game and Forests:

GENTLEMEN:—I take great pleasure in submitting my annual report for the year ending September 30, 1897, for the reason that the output of fish for the year exceeds by over twenty-two millions the output for any previous year.

Over two years ago your Commission decided that as far as possible fingerlings and yearlings were the most desirable size of fish to plant. Since that time your Commission has been striving to get our different hatcheries in shape for turning out this size or age of fish, and this fall five out of seven of our trout hatcheries are now meeting these requirements, whereas two years ago only two of the hatcheries could rear trout to this age. This required the expenditure of considerable money, but the results accomplished will prove the wisdom of your conclusions.

During the year 667,325 fingerlings and yearlings of brook, brown, rainbow and lake trout have been planted, in addition to the millions of fry, and next year, it is believed, a much larger number will be distributed.

In referring to fingerlings it may not be out of place to explain the term a little by giving the age and length. At about four to five months old we commence calling the young trout fingerlings and continue to designate them as such until they are from eleven to twelve months old, when we call them yearlings up to eighteen months old, when they are classed as eighteen months or two-year-old fish. The average length of a brook, brown or rainbow trout four months old is about two inches. At eight or nine months old they will average three inches, and at one year old five inches. These figures are exceeded at some hatching stations in the State. Lake trout grow faster than the other species, and at twelve months old will average six inches long. Fish at the same age are not always the same size. Sometimes the larger ones are capable of swallowing the smaller ones of the same hatch.

I am constantly in receipt of gratifying reports from different parts of the State in regard to the success of some particular plant of fry, fingerlings or yearlings. One protective association writes that the plant of fingerlings made a year ago was the only plant of fish this association ever made where practical results have been seen,

CONSTANTIA HATCHERY.

and they have been planting fry for years. The next season after planting these fingerlings (which were rainbow trout), specimens from ten to eleven inches long were caught.

Other reports have been received from plants of pike-perch fry made in waters that never contained them before, and in six months specimens five and six inches long were captured in minnow nets.

The large yearly increase in the number of applications for fry shows the increased interest our citizens are taking in the work of stocking the streams of the State. During the past year over one thousand applications for fish were received. Of this number 871 were filled at the number considered proper by your Hatchery Committee. Several were rejected on account of the waters named in the application not being considered proper for stocking; other applications were found to be for private waters. Great care has been taken to prevent the planting of State fish in private waters. A copy of the law is always sent to each applicant for fish.

At the Adirondack Hatchery, located at Saranac Inn station, Franklin county, many improvements have been made during the year.

One of the good results of work done was the rearing and planting of 12,000 fingerlings of brook and lake trout. This is the first output of fish larger than fry stages ever made from this hatchery. Brook, brown and lake trout, and frost fish are propagated at this hatchery.

It is possible to bring cold water enough to this place so that from one to two hundred thousand fingerlings and yearlings can be successfully raised each year in addition to the many thousands of fry that will be distributed.

At the Fulton Chain Hatchery, located at Old Forge, Herkimer county, a very large amount of satisfactory work has been done, consisting of the finishing of a large nursery or series of rearing ponds which are located on a spring brook tributary to the Old Forge pond about one-half mile from the hatchery proper. This site was obtained from the Old Forge Syndicate Company for a term of years, with the privilege of purchasing the same. Notwithstanding that some of these ponds were not built until late in the season, 15,500 fingerlings were turned out into the adjacent streams and lakes. There still remain at this hatchery about 25,000 fingerlings that will be retained until older before planting. This is the first year that this hatchery has been able to turn out fingerlings; next year's production should be much larger. Brook, brown and lake trout, and frost fish are propagated at this hatchery.

The interior of the hatchery has been entirely changed and remodeled, which greatly increases the hatching capacity. If aided by the property owners and citizens, it is among the possibilities of this hatchery to restore the Brown's Tract waters to their condition thirty years ago.

The Sacandaga Hatchery is located in the town of Lake Pleasant, Hamilton county.

It is impossible to raise fingerlings or yearlings at this hatchery as the water supply is so very uncertain during the summer months. In this respect the location of the plant was most unfortunate, but the section of country accessible from this hatchery abounds in numerous lakes and ponds, some of them the very finest for trout in all the Adirondacks, and as the Forest Preserve Board has recently purchased tracts of land and waters in the Adirondacks, I think it greatly influenced the Hatchery Committee in giving me instructions to put this hatchery in good shape. This has been accomplished during the past summer and the capacity so enlarged that next spring's plant of the different trout alone will amount to more than a million; in fact, the plant will be more than double that of any previous year. Brook, brown and lake trout, and frost fish are propagated at this hatchery.

People sometimes ask why frost fish are propagated as long as there is no chance for the people legally to catch them, as they can only be taken with nets. The principal reason for their propagation is the fact that they are the principal food of the lake trout in all of the Adirondack waters, and it is very seldom that you find a lake containing lake trout without its also containing frost fish.

The Beaver Kill Hatchery is located in the town of Rockland, Sullivan county.

On account of the lack of water during the summer months, little can be expected from this hatchery more than to hatch and turn out a few hundred thousand fry annually. Sullivan and the two adjoining counties of Ulster and Delaware probably contain as many natural trout brooks as any three counties of the State. From the condition of the country nearly all of these brooks are more or less subject to spring freshets, and for this important reason, fingerlings and yearlings are the most desirable age of fish to plant in this section. Without a doubt the three counties named entertain as many or more fishermen during the spring and summer than any other portion of the State.

If the hatchery remains where now located, better water must be obtained. It can be done by collecting waters from several springs located on the mountains a mile or less away, and piping it to the hatchery.

About 800,000 brook trout eggs from wild fish were collected near this hatchery during the past year, but on account of the limited water supply it was considered unwise to lay down for hatching more than a small portion of them at this hatchery, and the bulk of the eggs were sent to the Fulton Chain and the Caledonia Hatcheries. During the summer only one man was employed to look after the property.

The Pleasant Valley Hatchery, located near Bath, Steuben county, already ranks second in the State in the number of fingerlings and yearling trout distributed;

109,350 have been distributed from this hatchery during the past year, and the nursery ponds were only built during the year. Brook, brown, rainbow and lake trout are propagated at this hatchery.

One of the principal attractions in the fish line for visitors at this hatchery is a pond containing rainbow trout weighing from five to twelve pounds each. Without doubt it is the finest show of this variety in the eastern States.

Fish are not the only attraction. About a year ago the Commission directed the foreman of the hatchery, Mr. Cotchefer, to see what he could do in the way of breeding the Mongolian or ring-necked pheasant. The experiment proved very satisfactory; about forty pheasants were raised during the past summer. The coops were at once enlarged so as to accommodate them during the winter. Next season the Commission can commence turning loose quite a large number of surplus pheasants, so that the hatchery will soon be stocking the forests as well as the streams of the southern and central part of the State. With this fine show of fish, game birds and beautiful grounds, it is not to be wondered at that crowds of visitors almost daily inspect the plant, and that the Commission take great pride in what their labors have developed.

The Cold Spring Hatchery, located at Cold Spring, Suffolk county, N. Y., hatches and turns out a larger number of fish each year than any other hatchery in the State. This is due to the salt water branch of the work which consists of tom cods, smelt and lobsters. The hatch of these three exceeded by several millions the best record of any previous year.

Nineteen thousand six hundred and fifty fingerlings and yearlings were distributed during the year, and in addition, more than a million of trout at the fry stage. Brook, brown and rainbow trout, Atlantic and steelhead salmon, tom cods, smelt and lobsters are all propagated at this hatchery.

During the summer considerable necessary work, such as building new stock or breeding ponds, grading and general improvement of the grounds, was done.

The Caledonia Hatchery, located in the town of Caledonia, Livingston county, is the oldest and largest in the State, and I consider it to-day the best in the country.

A greater variety of fresh-water fish are hatched and distributed than from any of the other State hatcheries, and the facilities for rearing all kinds of trout to fingerlings and yearlings exceeds all the other State hatcheries combined, as the output will show.

Five hundred and nineteen thousand one hundred and eighty fingerlings and yearlings were distributed during the past year. Brook, brown, rainbow, red throat and lake trout, steelhead salmon, whitefish and pike-perch, are all propagated at this hatchery.

9

To give an idea of the extent of the distribution made from Caledonia, I would say, that between thirty-five and thirty-six hundred cans of young fish were sent out during the past year. The fish car belonging to the Commission (which is used in the transportation of large consignments), when loaded to its full working capacity will accommodate about 110 cans. This shows that over thirty carloads of fish were sent out from the hatchery.

During the year very extensive and substantial repairs have been made on the ponds and grounds. With the exception of the new nursery ponds recently put in, all of the ponds are now of stone laid in cement.

The Clayton Hatchery is located about three miles from Clayton Village, Jefferson county.

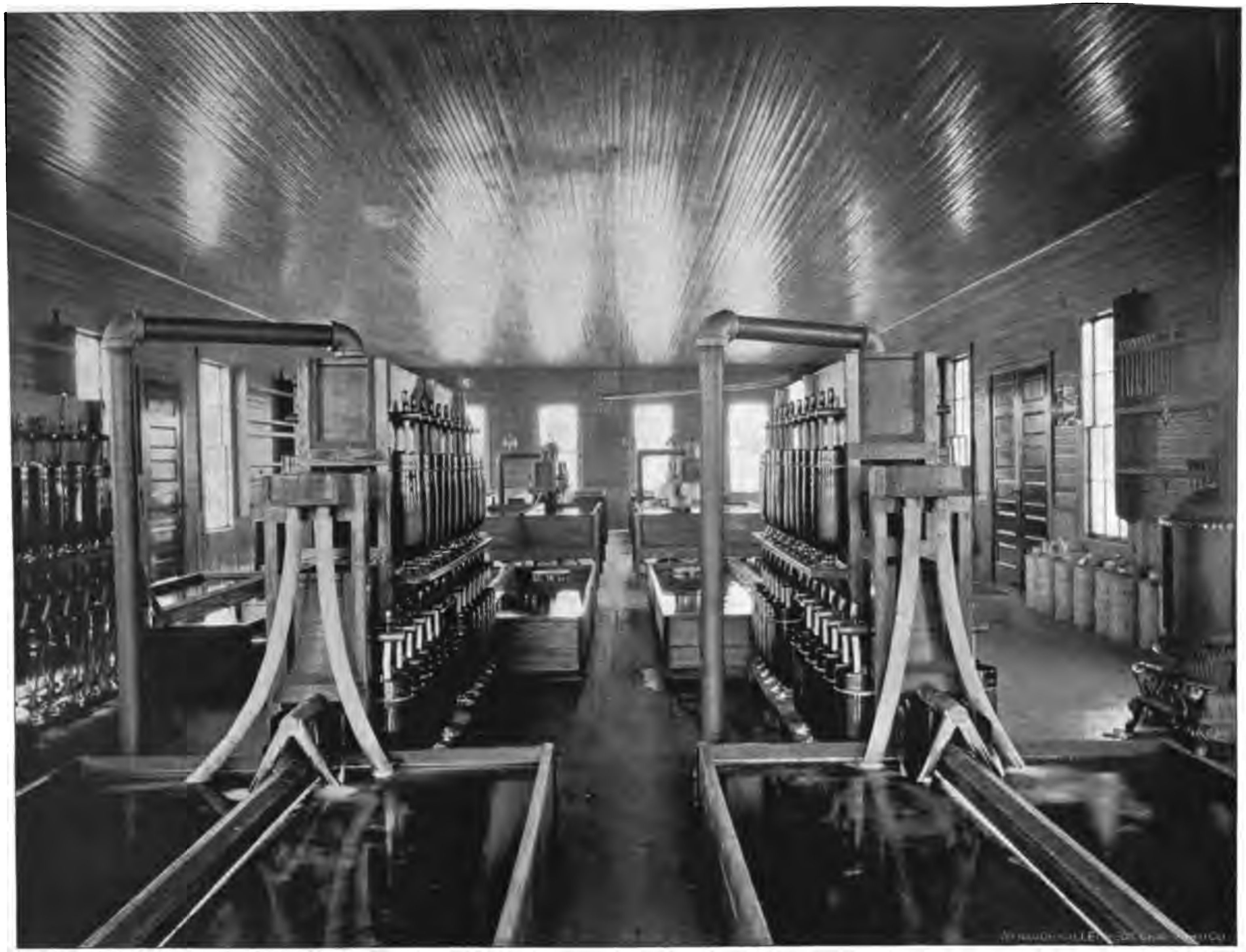
The State owns the hatching apparatus only. For about three months this summer, after the bass fry had been shipped, the hatchery was closed. Operations will commence again in October, collecting lake trout, whitefish and ciscoes. Large-mouth black-bass fry (often improperly called Oswego bass), are collected in the marshes along French creek within sight of the hatchery, by the hatchery employes. They are very small when caught, but gain in size so fast that they must be shipped almost immediately. Thirty-nine thousand of these young bass were distributed during the season. They were planted only in waters already containing large-mouth bass, and in no case were they granted to waters that only contained the small-mouth black bass.

Five thousand five hundred fingerlings, brown and lake trout were distributed during the year, but the cost of rearing them did not warrant continuing the work. The fish ordinarily propagated at this hatchery are whitefish, ciscoes and pike-perch.

The Constantia Hatchery, more commonly called the Pike-perch Hatchery, is located at Constantia, Oswego county.

At this place a creek empties into Oneida Lake, and for more than fifty years the stream has been noted for the great numbers of pike-perch that enter it every spring to spawn. This is where all the pike-perch eggs hatched by your Commission are taken. The original hatchery was a small affair, and only about half the eggs it was possible to collect each spring could be cared for and hatched. The site on which it was located did not belong to the State, and every year there was a heavy rental to meet. Thirty-two million eight hundred and five thousand pike-perch fry were hatched and distributed during the season from this hatchery.

During the last session of the Legislature an appropriation of $6,000 was made with which to purchase necessary lands and erect a fish hatchery for the purpose of the artificial propagation and distribution of food or commercial fishes, the site to be selected by the Fisheries, Game and Forest Commission.



CONSTANTIA HATCHERY. JARS FOR HATCHING PIKE-PERCH.

The appropriation came just in time, as last July an unusual heavy rain raised the creek to such an extent that all dams, bridges and some of the mills located on the stream were carried away, the State hatchery building going with the rest. The flood left the old site almost worthless.

During September your Commission decided on a site at Constantia for the new hatchery, the location being but a short distance from the old one, and on account of the building of black bass breeding ponds which you contemplate in connection with the new hatchery, I consider the new location much better than the former one.

The necessary land for the hatchery and ponds was kindly donated to the State by Mr. Romayne C. Robinson, of Parish, Oswego county. The deed conveys about seven acres of land, the water right and privilege of erecting a dam, and the right to flow five or six acres more.

The work of building the dam and hatchery was commenced at once, and everything will be ready for the next spawning season of the pike-perch in April. I am of the opinion that at least a part of our whitefish and ciscoe eggs can also be hatched at this new hatchery, which will be very convenient for plants intended for Lake Ontario. The estimated cost of the new dam and hatchery ready for business is about $4,000. This will leave $2,000 for the construction of the breeding ponds.

The Shad Hatchery is located at Catskill on the Hudson. Owing to the extremely high water and very cool weather during the spawning season the results this year were not satisfactory, as they fell below the hatch of last year. Cold, rainy weather, of course, makes considerable difference in the temperature of the river water. Shad are very susceptible to change of temperature; a falling temperature retards their spawning.

I would suggest that some way be provided by law, so that, if deemed necessary, your Commission could instruct me to fish for shad for propagating purposes after the legal season for catching the shad had closed.

I might mention that shad can not be caught in any kind of a net and returned to the water, expecting them to live; every one of them will die. The old fishermen say they die from fright.

The present law gives your Commission a right to take fish for propagating purposes, but it would seem as if some provision should be made for the lawful disposition of the shad so caught. It seems a needless waste to turn them back into the river, to die before they sink out of sight.

During the past season 2,068,000 fry were hatched and deposited in the river from your Catskill Hatchery. About 7,000,000 more fry were kindly donated to the State by the United States Fish Commission, and the fish car Adirondack made three trips to the United States Commission's shad hatcheries on the Susquehanna and

Delaware rivers. In this way the plant made in the Hudson river this season equalled the plant of last year.

All of the mascalonge hatching is done at Chautauqua lake in boxes with double-wire screen top and bottom, sunk in about four feet of water.

The season's work was highly satisfactory, in both the number hatched and the quality of the fry planted. The output of the mascalonge fry for the year was 3,075,000, which beats any previous record by nearly a million.

The Commission has been very careful about granting applications for mascalonge fry for planting in inland waters, as they make a most wonderful growth and reach an enormous size. They can be well named the fresh-water shark. If planted in many of the small inland lakes the result would be that the perch, pickerel and bass fishing in these waters would be greatly damaged.

Applications for mascalonge fry for proper waters, such as the St. Lawrence and Niagara rivers or Lake Ontario, have been granted as far as possible.

In this connection mention should be made of the garpike or billfish extermination that has been carried on at different times during the past two seasons at Chautauqua lake, two special appropriations, one of $1,000 and the other of $500, being made by the Legislature to carry on the work.

It has been impossible to make a yearly report before, as the first season's work was not completed at the end of a fiscal year.

The appropriations were made at the request of the Farmers' and Citizens' Game and Fish Protective Association of Chautauqua county, the members of the association being of the opinion that the billfish were destroying large numbers of game fish in the lake, such as young bass and mascalonge. This I found was true, to some extent, as I opened several of the billfish and made an examination of their stomachs, and in two cases found young black bass.

Before the work was commenced, advice as to the right time of the year and where to find thousands of the billfish was freely offered, but as no one had ever made a business of fishing in any manner for this worthless fish, it was decided that the first year we would commence netting in September, and the next season carry it on from the close of the mascalonge hatching season in May into the month of July so as to cover all the time during which, I had been informed, these fish could be seen in great numbers.

Seines, pound and trap nets were used in the work, as the game fish that would necessarily be caught could be returned to the lake without injury if caught with the above nets. The pound nets did by far the best work, and the second season were used exclusively. To cover as much territory as possible a small steam yacht was chartered to carry the nets every two to four days to new fishing grounds. In this way all portions of the lake were carefully fished.

TAKING EGGS FROM PIKE-PERCH AT CONSTANTIA.

The second season's work was carried on during the summer of 1897, and lasted longer than that of the previous year. More nets were also in use, but the result was not as satisfactory as to number of billfish captured, but again it was highly satisfactory, as the following figures will show that we had already reduced the number of billfish in the lake and that they were not as numerous as reported.

There still remains an unexpended balance of $127.49, which, with careful management, should be sufficient to reduce the stock of billfish in Chautauqua lake so that it will be unnecessary for further appropriations.

During the whole two seasons' work no game fish were killed.

The billfish caught would weigh from three-quarters of a pound to twelve pounds each.

Billfish caught and killed during the year 1896,	2,606
Billfish caught and killed during the year 1897,	1,316
Total,	3,922

Whitefish.—Early in the fiscal year it was found that in Canandaigua lake there were quantities of the Labrador whitefish, which is one of the very best for the table, and that their spawning beds were all located where pound nets could be readily set to catch them as they went on the beds to spawn. Pound nets are one of the few nets used that do not kill or injure the fish, but as these nets had never been set there before, and as no one could tell just the day the whitefish commenced spawning in Canandaigua lake, the first year's attempt was an experiment, and the result was awaited with considerable anxiety. The nets were put in the last of October so as to be on time. The setting of a pound net is no small job, as soundings have first to be carefully made as to depth and condition of the bottom, for some of the stakes used in setting the nets are from fifteen to twenty-four feet long. They have to be driven from boats when there is no wind. The netting or webbing alone to some of the single nets weighs from seven to eight hundred pounds, and it must be set securely to withstand the winds and oftentimes ice, as the nets are never taken up until the fishing is finished for the season.

It was a pleasure to receive a telegram from the men in charge of the nets saying that they had caught nearly 500 whitefish the night before, but that the fish were not ready to spawn. That catch settled the question as to whether our nets were in the proper places. The whitefish spawn at night, going on the beds after dark and returning to the deep water before daylight. By going to the nets every morning and handling a few of the fish an expert can tell about how long it will be before the fish are ready to spawn. If, in his opinion, it will be some days, then he raises the shore end of the net (which is called the leader) at the point where it goes into the

heart. By doing this the net will not fish. This was done several times until about the middle of November, and on the 19th the first ripe fish was secured and eggs taken. The last eggs were taken on the 19th of December, their spawning season lasting exactly a month; but the bulk of the eggs were taken within ten days. We secured about 13,000,000 eggs; 11,000,000 of them were hatched at Caledonia; 5,000,000 of the fry so hatched were returned into the lake.

By continuing liberal plants each year, Canandaigua lake can be made to produce whitefish eggs enough so that your Commission can restock Lake Ontario with this desirable fish. But in the first place the fish in Canandaigua lake must be thoroughly protected by law. The best authorities of the country predict that at the rate the whitefish are being exterminated ten years will see them a great rarity in the markets. Already the large fishing concerns of the Great Lakes are going to Lake Superior and the smaller lakes west and northwest of Lake Superior in Manitoba for their stock of fish, a great majority of which are frozen and not put on the market for from three to six months after being caught.

Following is a summary of the output of fish.

Also attached is a list showing the value of State property at the different hatcheries. All of this property is kept fully insured.

In conclusion I wish to call attention to the liberal and continuous courtesies extended to the Commission by the railroads of the State in hauling free the State fish car, and transporting free the messengers in charge of fish, fish eggs and returning the empty fish cans.

Yours respectfully,

J. ANNIN, JR.,

Superintendent of Hatcheries.

Distribution of Fish for Year Ending September 30, 1897.

SPECIES.	AGE.	AMOUNT PLANTED.	
Brook trout,	Fry,	3,729,000	
Brook trout,	Fingerlings,	118,500	
Brook trout,	Yearlings and older,	31,902	
	Total,		3,879,402
Brown trout,	Fry,	893,000	
Brown trout,	Fingerlings,	88,150	
Brown trout,	Yearlings,	10,400	
Brown trout,	Adult,	251	
	Total,		991,801
Rainbow trout,	Fry,	100,000	
Rainbow trout,	Fingerlings and yearlings,	43,580	
Rainbow trout,	Adult and 18 months old,	1,220	
	Total,		144,800
Lake trout,	Fry,	2,445,000	
Lake trout,	Fingerlings,	364,050	
Lake trout,	Yearlings,	4,933	
	Total,		2,813,983
Land-locked salmon,	Fingerlings,	1,220	
Land-locked salmon,	Yearlings,	834	
	Total,		2,054
Steel-head salmon,	Two months,	3,750	
Steel-head salmon,	Fingerlings, etc.,	10,753	
	Total,		14,503
Swiss lake trout,	Fingerlings,	1,000	
Swiss lake trout,	Yearlings,	3,200	
	Total,		4,200
Scotch sea trout,	Yearlings,	708	
Shrimp,	Fry,	20,000	
Red-throat trout,	Two years,	3	
Atlantic salmon,	Fry,	80,000	
Whitefish,	Fry,	21,660,000	
Smelt,	Fry,	45,000,000	
Ciscoes,	Fry,	14,500,000	
Frostfish,	Fry,	10,600,000	
Tom cods,	Fry,	44,675,000	
	Forward,	136,535,711	7,850,743

SPECIES.	AGE.		AMOUNT PLANTED.	
		Brought forward,	136,535,711	7,850,743
Shad,	Fry,		10,118,000	
Wall-eyed pike,	Fry,		49,405,000	
Mascalonge,	Fry,		3,075,000	
Lobsters,	Fry,		6,896,420	
Black bass (Oswego),	Fry,		39,000	
Bullheads,	Fry,		2,700	
White perch,	Adult,		120	
				206,071,951
		Grand total,		213,922,694

Total Distribution of Trout of All Kinds.

Fry,	7,167,000	
Fingerlings (6 to 8 and 10 months old),	616,500	
Yearlings,	51,394	
		7,834,894

Value of Property at the Various Hatcheries.

Adirondack Hatchery,	$9,020 55	
Beaver Kill Hatchery,	4,901 22	
Caledonia Hatchery,	35,559 46	
Catskill Shad Hatchery,	611 58	
Chautauqua Hatchery,	993 34	
Clayton Hatchery,	395 20	
Cold Spring Hatchery,	14,133 83	
Constantia Hatchery,	100 00	
Fulton Chain Hatchery,	5,619 55	
Pleasant Valley Hatchery,	12,696 17	
Sacandaga Hatchery,	6,527 30	
Office Superintendent of Hatcheries,	758 75	
		$91,316 95

Report of the Shellfish Commissioner.

To the Commissioners of Fisheries, Game and Forests:

GENTLEMEN:—I have the honor of transmitting the following preliminary report of the Shellfish Department of the Fisheries, Game and Forest Commission, of which I have charge. During the past year there have been eighty-two applications for oyster lots, covering 672 acres, all of which have been executed and filed. Sixty-three leases of oyster lots have been made, and sixty-eight oyster lots of different sizes and shapes have been located and surveyed, being situated principally in Jamaica and Sheepshead bays. I regret to say that no applications have been made for lands under water in Long Island sound, owing to the fact that our oyster men do not consider a fifteen-year lease sufficient to warrant them in taking up these grounds where it requires large capital to operate and carry on the business. I sincerely trust that your honorable body will see fit to recommend that the Legislature enact a law to permit this Commission to grant perpetual franchises for this vast territory, the same as the oyster men of Connecticut have. It is safe to estimate that there are 200,000 acres of uncultivated oyster land in Long Island sound, State of New York, and it would seem to me that liberal inducements should be offered to our citizens, in order to increase the supply of this great article of food. To those who are not observant of this great industry it is hard to explain that while in the shoal waters of big bays a fifteen-year lease is very good, yet in the deep water of Long Island sound, where it requires large capital and large steamers to operate the grounds, together with the uncertainty of producing a crop, and where the natural enemy of the oyster abounds, we find that oyster men will not risk their capital on a fifteen-year lease; and it is for this reason that we earnestly recommend the granting of perpetual franchises in Long Island sound and Prince's and Raritan bays. The State Engineer has done a great deal toward forwarding the work of this office, and his kindly attention has been appreciated. Many new signals have been located and built, and old ones repaired. The work of the hydrographic survey, under the supervision of Mr. Charles Wyeth, C. E., has proceeded satisfactorily.

Later, in a final report, I will give more in detail the work of this department.

All of which is respectfully submitted,

EDWARD THOMPSON,

Shellfish Commissioner.

Report of the Superintendent of Forests.

AREA OF THE FOREST PRESERVE.

ALBANY, N. Y., *December* 31, 1897.

To the Commissioners of Fisheries, Game and Forests:

GENTLEMEN:—I have the honor to submit the following report, showing the location and acreage of the lands constituting the Forest Preserve at the present time. The delay in publication has enabled me to make the changes necessary to bring it down to September 30, 1897. This schedule of lots and parcels is based on the records of the Comptroller's office, with the exception of one tract, containing 7,500* acres, which does not appear on the Comptroller's land list, but which is included in the schedule appended here. This tract—S. E. ¼, Township 24, Franklin county—was formerly borne on the land list, but the State's title having been canceled in 1891 by the Comptroller, it was stricken from the list as recorded in that office. In the meantime the Court of Appeals rendered a decision that the title is still vested in the State, in view of which I have retained it in our schedule of lands and on our Adirondack map, have colored it red to indicate that it still forms part of the Forest Preserve.

This schedule does not include any of the lands recently purchased by the Forest Preserve Board which, at the time of going to press, amounts to over 250,000 acres. The various tracts and parcels composing this large and valuable addition to the preserve will appear in the next publication of the land list.

From the following schedule it appears that, exclusive of the area acquired by the purchase made by the Forest Preserve Board, the State Preserve contains at the present time 908,904 acres. Of this area the Adirondack Preserve contains 852,392 acres, and the Catskill Preserve 56,512 acres. These figures include the 39,564 acres acquired by the tax sale of 1895.

The acreage of the preserve, as contained in each county, is as follows:

AN UNEXPECTED OPPORTUNITY.

Adirondack Preserve.

Counties.	Acres.
Clinton,	17,863
Essex,	197,124
Fulton,	18,899
Franklin,	80,498
Hamilton,	291,844
Herkimer,	88,681
Lewis,	4,377
Oneida,	5,237
St. Lawrence,	30,612
Saratoga,	9,110
Warren,	72,868
Washington,	1,241
Total,	818,354

Catskill Preserve.

Delaware.	11,146
Greene,	796
Sullivan,	609
Ulster,	38,435
Total,	50,986

Additional Lands Acquired at the Tax Sale of 1895.

Adirondack Preserve.

Counties.	Acres.
Clinton,	3,273
Essex,	4,018
Franklin,	4,071
Fulton,	2,620
Hamilton,	2,726
Herkimer,	85
Lewis,	170
Oneida,	120
St. Lawrence,	2,155
Saratoga,	2,298
Warren,	12,502
Total,	34,038

Catskill Preserve.

Counties.	Acres.
Delaware,	2,982
Greene,	564
Sullivan,	688
Ulster,	1,292
Total,	5,526

Recapitulation.

Adirondack Preserve,	818,354
Catskill Preserve,	50,986
Adirondack Preserve, tax sale of 1895,	34,038
Catskill Preserve, tax sale of 1895,	5,526
Total,	908,904

The lands acquired through the tax sale of 1895 are stated separately because there may yet be some redemptions which will diminish the acreage embraced in this particular amount. The time for redemption from the sale of 1895 has expired, except in the case of the few lots on which there may be an occupancy. Such occupancy may consist not only of a house or barn, but also in the use of the land for agricultural purposes. While the time for redemption for wild or forest land is limited to one year, lands on which there is an occupancy may be redeemed at any time within three years from the date of sale. The title to the lands in the 1895 list will, therefore, not become absolute until December, 1898. It is expected, however, that but few redemptions will be made from this list of 1895, as the lots are nearly all wild or forest land.

For the information of those, other than your Board, who may chance to read this report, it should be stated that there is an important difference between the Forest Preserve and the Adirondack Park. The former embraces all the lands owned by the State in the Adirondack and Catskill counties; the latter, only such State lands as are situated within the boundary fixed by law, and which is indicated on the Adirondack map by the blue line. The State lands in the counties of Clinton, Fulton, Lewis, Oneida, Saratoga and Warren are in the Forest Preserve, but none of them are situated within the lines of the Adirondack Park. While there are 852,392 acres in the Adirondack Preserve, 155,504 acres of this amount lie outside of the Adirondack Park, and some of it a long way from the park.

Prior to the purchases made by the Forest Preserve Board, under the recent appropriation of $1,000,000, that part of the Forest Preserve which is contained in the Adirondack Park contained 696,888 acres. This area has been increased by the recent purchases referred to until the Adirondack Park contains to-day 946,888 acres. In addition to this amount there are the outside lands in the Adirondack Preserve,

155,504 acres, and the Catskill Preserve, 56,512 acres, making in all a combined acreage in the Forest Preserve, Adirondacks and Catskills of over 1,100,000 acres.

The preparation of this land list and computation of areas has consumed considerable time and involved no small amount of technical work.

It is the foundation on which the entire landed and forestry work of the Department is based. The State lands on our Adirondack map, as shown in colored areas, could not be correctly indicated except by the use of this land list. It is the only guide that our foresters have in patrolling the forest and protecting the preserve.

I would respectfully suggest that this land list be printed as a separate or second volume of the annual report. As the work contains no reading matter or little of interest to the general public, I would respectfully suggest that the edition be limited to such number only as may be necessary for the use of the officials and foresters, with some additional copies for the Comptroller's office, and to supply the demand made by people who own adjacent lands.

The business connected with the care and maintenance of the State forests has been carried on during the past year with nothing of an unusual character to mark the continuance of the work. Owing to the restrictions of the new State Constitution no effort has been made to accomplish anything in the line of forestry proper, the management of the public woodlands being confined to the routine of police duty and forest preservation. There has been no timber cutting or trespassing other than the petty thefts which are liable to continue on the outlying lands as long as the widely scattered lots outside the park lines are held by the State. There are many of these isolated lots situated at long distances from the main forest, which can not be entirely guarded by the small number of foresters in our employ, their attention being almost wholly occupied in looking after the tracts situated in the main forest. Some of these small outlying lots have cost the State more money for taxes and protection than they would bring if sold to the highest bidder.

There have been no depredations worth mentioning in the main forest, and these will soon cease entirely when the land purchases now being made or further contemplated shall have consolidated and extended the State holdings in one vast contiguous tract. The suppression of timber stealing and spoliation of the public woodlands is due to the zealous work of the foresters, and the Commission takes pleasure in acknowledging here their activity and efficiency.

Forest fires still occur in the woodlands of the Adirondack and Catskill counties and other parts of the State, but there have been none of any consequence in the State forests during the past year. The total area of private woodlands burned over is small as compared with former years. This is due largely to the wet weather which prevailed at the time when most of these fires occur.

In the litigation of titles to lands in the Forest Preserve, the Commission has been successful in every case. In one important suit, The people v. Benton Turner, the defendant appealed his case to the United States Supreme Court at Washington, where a decision was rendered in favor of the State. This opinion confirmed the constitutionality of chapter 448, Laws of 1885, which provides that all conveyances by the Comptroller of lands sold at tax sales, after being recorded two years in the county clerk's office, and all outstanding certificates of a tax sale that are in force two years after the time for redemption expires, shall, six months after the passage of this act, be conclusive evidence that the sale and all proceedings prior thereto were regular, and shall be conclusive evidence thereof after two years from the date of recording such conveyances or four years from the date of such certificate.

The enactment of this law and the affirmation of its constitutionality by the United States Supreme Court perfects the title to the Forest Preserves and relieves the State from further litigation arising out of alleged irregularities in the assessments or tax sales through which the public obtained these lands. The case was ably argued by Attorney-General Hancock on the part of the State. The important issues involved render the successful termination of this twelve-years' lawsuit a matter of congratulation to all who have the forestry interests of the State at heart.

Another suit, which was brought by a land company to obtain possession of Lower Saranac lake and the adjacent lands, was tried before Judge Coxe in the United States District Court, at Utica. This case was tried in March, 1896, the Commission being represented by Deputy Attorney-General Hasbrouck. The decision in this suit, which was not rendered until October, 1897, was also in favor of the State, and secures the undisturbed possession of a magnificent piece of property, with all its wealth of forests, lakes, islands and unsurpassed scenery.

Counsel has been retained and proceedings begun by this department before the State Comptroller, under the provisions of chapter 392, Laws of 1897, for the purpose of setting aside the Comptroller's cancellations of the tax sales of 1877, 1881 and 1885 upon Township 20, Franklin county, and 6,280 acres in the southeast quarter of Township 23, Franklin county, and upon Lots 27, 28, 41, 88, 89, 90, 92, 93, 95 and 98 in the north one-half of Arthurboro Patent, Hamilton county.

In estimating the cost of maintaining a forest department it might be well to note the success with which it has contested for years every attempt to wrest land from the State through the action of the courts and prevented the loss of forest tracts worth many hundred thousand dollars.

WILLIAM F. FOX,
Superintendent of Forests.

The State Reservation Upon and Along the St. Lawrence River.

CHAPTER 802 of Laws of 1896 provided for the establishment of a State reservation upon and along the St. Lawrence river in the State of New York, to be under the control and management of the Fisheries, Game and Forest Commission, the Board having power to make and enforce ordinances, by-laws, rules and regulations for the management of the property of the State within the borders of said reservation.

At the time of the passage of the act the State had no property whatsoever in lands in or on the St. Lawrence, but an appropriation of $30,000 was made that the Commission might acquire for the State, islands in the river, or parcels of the mainland along the river, to create such a park as was contemplated by the provisions of the act. Contemporaneously with the passage of chapter 802, the government of the Dominion of Canada set aside about twenty-five islands on the Canadian side of the St. Lawrence for a public park of international character with the general understanding that the State of New York would co-operate in establishing a park or reservation to be open for health or pleasure purposes to people living on both sides of the river. The boundaries of the park reservation include all of the St. Lawrence river and the islands that are in the State of New York, making over one hundred miles of stream, extending from Lake Ontario to a point below Massena. The Dominion of Canada has never parted with the title to the islands belonging to the Crown, and an act of Parliament was all that was required to create the Canadian portion of the park, and this was promptly passed, and some of the most beautiful islands in the Canadian portion of the river are now devoted to park purposes. As New York had to acquire title to any and all islands or lands that might be selected for the park, the members of the Commission made a visit to the river soon after the appropriation became available, and thoroughly inspected the islands and lands which had been offered for sale. When it was known that the State desired to become a purchaser of river property, owners or agents filed with the Commission descriptions of about fifty pieces of property, island and mainland, which they desired to sell under the provisions of the act. Each piece of property from Lake Ontario to Massena was carefully examined.

The object of creating a public park on the St. Lawrence was that it might be used by the people for picnics, excursions, camping, health and recreation generally,

and it is most commendable, and was absolutely necessary, if the people generally were to enjoy this great playground, for the islands and mainland are private property from which the public is excluded.

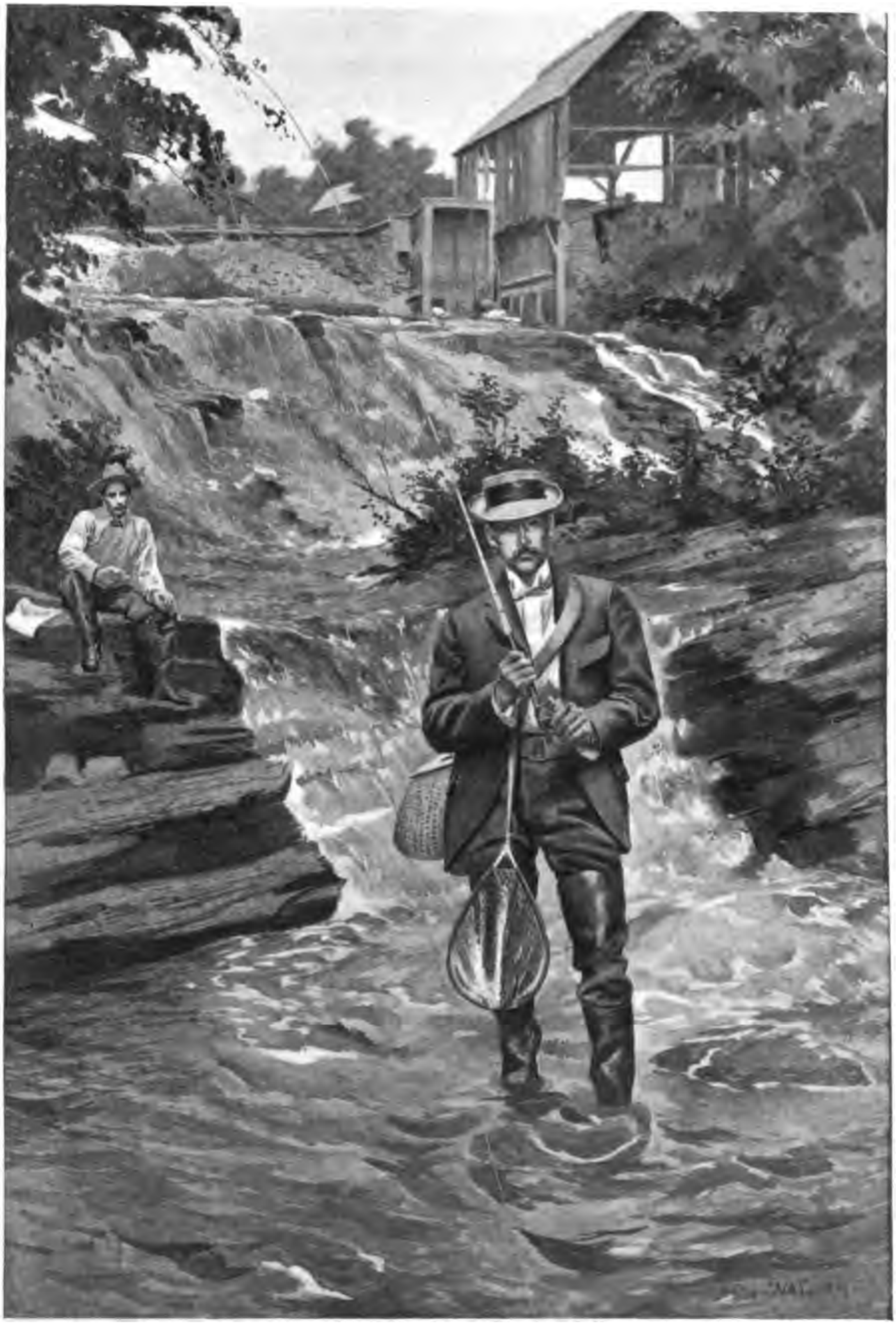
The Commissioners, in making selections of property to be purchased for the park, had several things to consider: the location of the various parcels and their availability from the towns and villages on the shores; the price; the means of communication; their location in connection with the fishing grounds; and, finally, their adaptability as harbors of refuge to those who trust themselves on this great river, which, like all large bodies of water, is subject to storms that threaten the small craft so much used by excursionist and camper. For this reason the Commissioners have sought to acquire islands or mainland having a natural harbor and landing shore for small boats, and also for landing passengers from the small steam yachts so much employed on this waterway.

After several visits to the river to examine and re-examine the different properties offered for sale, the Commission has purchased Mary's island at the foot of Westminster park, near Alexandria bay, for $5,000; and seventy acres of the foot of Grindstone island near Eel bay, and widely known as Canoe Point, for $4,206.

Options have also been obtained on several properties, and the entire appropriation will be expended in making the most desirable purchases possible before the close of the present session of the Legislature. It will be necessary to ask for an appropriation for the purpose of clearing up the land purchased, and to be purchased, to reduce to the minimum dangers from fire; for building landing docks for river craft, and shelters for the people who visit the park in case of storms.

In selecting property for the park the Commissioners have tried to consult the convenience not only of the people who live in the towns along the river, but also the people in the State at large who may desire to visit the park by means of the organized lines of travel. At the same time it has been the object of the Board to secure desirable property from a commercial point of view, well wooded, and of suitable size, with proper and convenient water approaches.

As the Dominion of Canada has taken and is taking an active interest in creating the park, to which she contributes a greater number of islands than this State can hope to contribute, for the reasons already stated, and as the islands and mainlands will be open to the people generally from both sides of the river, it will be most desirable that the fish, game and forest laws applying to the river should be uniform, and to this end, we would recommend that laws be enacted for the St. Lawrence river such as Canada will also be willing to enact for the government of the waters and lands within the confines of the park.



AN IDEAL TROUT POOL.

Suggestions and Recommendations.

IN our report of last year we recommended that power be granted to this Commission, by legislative enactment, to close waters for a term of years not to exceed five, when in the judgment of the Commissioners such action is necessary to establish or re-establish fish in such waters. This power is given to Fisheries Commissioners in other States and it is most desirable that this Commission should have similar powers, the waters to be closed by posting notices on the banks of the streams or lakes which are to be stocked or restocked, and by notices in the local newspapers stating the period for which the waters are closed to all fishing. The tendency is to fish a stream as soon as it is stocked, and in the case of newly-planted waters, the fish should be allowed to grow to maturity and spawn at least once before fishing is permitted, if the fish are to be permanently established in the waters.

At present the Commission must go to the Legislature and urge that the machinery of that body be set in motion to close a stream a few miles in length when the same result may be attained by a few posted notices signed by the Commission, provided that the Legislature grants that power to this Board.

The Fish and Game Laws now in force, article XV, throws around the waters of the St. Lawrence river certain safeguards not enjoyed by other portions of the State, and these safeguards, properly enforced, will do much to keep up the supply of fish food in that stream. We would recommend that certain provisions of article XV be applied to all the waters of the State, viz.: Sections 319 and 320 giving right of search without warrant; section 315 making the limit of length for black bass ten inches; section 316 limiting the number of black bass to be taken by one person in one day to twelve.

Black bass is the common game fish of the people of the State, and as it cannot be hatched artificially like trout, pike-perch and shad, it requires unusual restrictions about it, if the fish is to be preserved. Already complaint comes to the Commission of its scarcity in some waters, and applications are sent in for millions of black bass which cannot be filled. To prevent its ultimate extermination, laws must be enacted to preserve the stock now in the waters or stock fish must be purchased from waters outside of the State. Prudence suggests that we make every possible effort to preserve the fish we have and to that end we earnestly urge that black bass be included among the fish mentioned in section 109, and that the open season for fishing for black bass close on the 31st of October of each year. Black bass differ from other food fish more than in their breeding habit, which does not permit of artificial propa-

gation, for they are a fish that partly hibernate as cold weather approaches, and for this purpose resort in large numbers to shoals in deep water or clefts in sunken rocks, and from such places, after November 1st, great numbers of large black bass are taken and marketed. They afford no sport, and if allowed to remain in the water the following spring would do much to keep up the supply of that species.

Last year we vigorously urged that section 249 be repealed, as it permits the sale of game the year around, and while that law remains unrepealed it is a hopeless task to protect the game of the State from destruction. We again urge that this section be stricken from the Game Law, that all of our game animals and birds may not suffer from its blighting influence. We have found it almost impossible to obtain a conviction for killing our own game birds at any time of the year with this section in force, and the law is, as we have already pointed out, unjust to sister States that have non-export laws. Theoretically, the law may be all that its sponsors claim for it, but in practice it is slowly but surely working the greatest injury to our native game.

BLACK BASS EXERCISING.

FALL FISH OR SILVER CHUB.

(SEMOTILUS BULLARIS. Rafinesque.)

Distribution of Fish.

Schedule of Waters Stocked for Year Ending September 30, 1897.

DISTRIBUTION OF BROOK TROUT FRY.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
William J. Youngs,	Cove Brook,	Oyster Bay,	Queens,	15,000
W. E. Humes,	Mid. Branch Oswegatchie River,	Diana,	Lewis,	10,000
F. H. Wager et al.,	Dupkill Creek,	Schaghticoke,	Rensselaer,	2,000
Thomas H. Larkins,	Douglas Brook,	Pomfret and Dunkirk,	Chautauqua,	10,000
W. S. Grow,	Flint Creek and other streams,	Italy,	Yates,	10,000
D. W. Bullock,	Shoharie Creek, etc.,	Hunter,	Greene,	20,000
E. W. Hurlbut,	Headwaters Bronx River,	Pleasantville,	Westchester,	15,000
C. R. Kennedy,	Meadow Brook,	Huron,	Wayne,	5,000
Irving D. Rhodes,	Peterskill,	Rochester,	Ulster,	10,000
W. E. McCasland,	True Brook and tributaries,	Saranac,	Clinton,	15,000
G. W. Lamont,	Big Indian Creek, etc.,	Big Indian,	Ulster,	20,000
De Ruyter Sportsmen Club,	Tioughnioga River, etc.,	De Ruyter,	Madison,	10,000
C. Hicks,	Clinton Corners Stream,	Clinton Corners,	Dutchess,	8,000
Lincklaen Fish Club,	Mud Creek,	Lincklaen,	Chenango,	10,000
W. G. Young & Co.,	"	Kirkland, New Hartford and Whitestown,	Oneida,	8,000
John McLaughlin,	Raquette Lake and other waters,	Long Lake,	Hamilton,	25,000
Eber Furlow,	West Branch Bemus Creek,	Ellery,	Chautauqua,	5,000
William R. Clark,	East Branch Bemus Creek,	"	"	5,000
C. A. Cartwright,	Owego Lake,	Newark Valley,	Tioga,	10,000
W. J. Ayres & Son,	Twin Lakes,	Malone,	Franklin,	10,000
T. C. Porter,	Chestnut,	Neversink,	Sullivan,	10,000
F. R. Bain,	Sherman Brook, etc.,	Amenia and Dover,	Dutchess,	10,000
H. W. Fanning,	Catskill Creek, etc.,	Durham,	Greene,	10,000
F. W. Abrams,	Tea Lake,	Arietta,	Hamilton,	25,000
E. D. Crosley,	Cold Brook, etc.,	Spofford, Scott and Homer,	Onondaga, etc.,	15,000

DISTRIBUTION OF BROOK TROUT FRY.—Continued.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Darwin J. Day,	St. Regis River etc.,	Waverly,	Franklin,	10,000
M. C. Paul,	Blue Mt. Lake,	Indian Lake,	Hamilton,	35,000
H. A. Howan,	Burgess Brook, etc.,	Hague,	Warren,	10,000
E. M. Moore et al.,	Trout Brook, etc.,	Richland,	Oswego,	10,000
Jerome Fletcher,	Cato Mountain Brook,	Franklin,	Franklin,	10,000
Charles Bryant,	Lyon Brook,	Franklin,	Franklin,	10,000
W. H. Hinds & Son,	Palmers Brook, etc.,	Black Crook and Peru,	Clinton,	10,000
M. F. Derby,	Otter Pond,	Santa Clara,	Franklin,	10,000
W. J. Maxwell,	Duguins Creek,	Caledonia,	Livingston,	5,000
M. D. Struter et al.,	Spring Brook, etc.,	Richland,	Oswego,	10,000
Salamanca Gun & Rod Club,	Newton Run Creek,	Salamanca,	Cattaraugus,	3,000
" " "	Harkness Creek,	Great Valley,	"	5,000
J. D. Mosley,	Sacandaga Lake,	Lake Pleasant,	Hamilton,	30,000
W. H. Walker,	Christie Creek,	Caledonia,	Livingston,	2,000
Will Osborn,	Cherry Brook,	Lake Pleasant,	Hamilton,	12,000
William H. Bartlett,	Southfield Brook, etc.,	Washington and Amenia,	Dutchess,	8,000
F. Sawyer,	Upper Chateaugay Lake,	Dannemora,	Clinton,	25,000
Geneganslet Fish & Game Pro. Assn.,	Gates Creek, etc.,	Smithville, German and McDonough,	Chenango,	20,000
Olean Sportsman's Club,	Waymouth Creek, etc.,	Olean,	Cattaraugus,	15,000
B. W. Carson,	Round Pond,	North Hudson,	Essex,	20,000
D. B. Cole,	Dry Brook,	Middletown,	Delaware,	20,000
Frank E. Kuran,	Batavia Kill,	Windham,	Greene,	15,000
T. Cary,	Spring Creek,	Elbar,	Genesee,	5,000
M. W. Smith,	Croton River, etc.,	South East,	Putnam,	15,000
John S. Eells,	Arnold Brook, etc.,	Peru,	Clinton,	10,000
Addison McIntyre,	Mill Brook,	Lake Pleasant,	Hamilton,	15,000

DISTRIBUTION OF BROOK TROUT FRY.—Continued.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Ira S. Smith,	Wawayanda Creek, etc.,	Warwick,	Orange,	10,000
E. A. Dox,	Cobbleskill Creek,	Richmondville,	Schoharie,	10,000
W. B. Martin,	Bushkill,	Shandaken,	Ulster,	10,000
Saratoga Fish & Game Pro. Assn.,	Various streams,	Saratoga, Wilton, etc.,	Saratoga,	15,000
James Walton,	Snyder Hollow Stream,	Shandaken,	Ulster,	10,000
A. J. Simpson,	Esopus Creek,	"	"	15,000
S. C. Cooper,	Various streams,	Middlefield and Milford,	Otsego,	8,000
H. F. Pulver,	Punch Brook,	Pine Plains and Ancram,	Dutchess and Columbia,	6,000
E. G. Johnson,	Handsome Brook,	Franklin,	Delaware,	8,000
Jerome Holmes,	Pleasant Brook,	Brookfield and Hamilt'n,	Madison,	8,000
J. W. Pond,	Ragged Lake,	Bellmont,	Franklin,	25,000
M. S. Ives,	Various streams,	Turin,	Lewis,	15,000
Ahira Green,	Lake,	Colchester,	Delaware,	2,000
W. Schwarzallder & Co.,	Big Ox Clove Creek,	Chichester,	Ulster,	15,000
Albert Danforth,	Whitney Lake,	Arietta,	Hamilton,	15,000
Judson Newman Smith,	Big Trout Pond,	Atherton,	St. Lawrence,	5,000
W. O. Ensign,	Willowemoe stream,	Livingston Manor,	Sullivan,	10,000
A. E. Darrow,	Various streams,	Little Valley and Mansfield,	Cattaraugus,	10,000
John Bartholomew,	"	Providence and Broadalbin,	Saratoga and Fulton,	15,000
J. B. Mills,	"	Chester,	Warren,	25,000
Loon Lake Hotel Co.,	Loon Lake,	Franklin,	Franklin,	25,000
Minot S. Mitchell,	Dark Hollow Brook,	Smyrna, N. Norwich, etc.	Chenango,	8,000
C. A. Cline,	Tributaries to Ten-Mile River,	North East,	Dutchess,	8,000
Henry Sanford,	Various streams,	Middletown,	Delaware,	10,000

DISTRIBUTION OF BROOK TROUT FRY.—CONTINUED.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Rome State Custodial Asylum,	Spring Ponds,	Rome,	Oneida,	5,000
B. F. Gadding,	Otselic Creek,	Broome, Otselic, Pharsalia and Chenango,	Chenango,	10,000
George W. Cushman,	Lake Titus,	Malone,	Franklin,	15,000
Delevan Rod and Gun Club,	Various streams,	Yorkshire,	Cattaraugus,	10,000
J. W. Rigley et al.,	"	Volney, Hannibal, Palermo,	Oswego,	15,000
Sherburne Fish and Game Association,	"	Sherburne,	Chenango,	10,000
J. M. Case,	"	Gilboa and Cornersville,	Schoharie,	15,000
Frederick Mitchell,	Titus,	North Norwich,	Chenango,	5,000
B. L. Crandall,	Canasawatka Creek,	Pharsalia, Plymouth and Norwich,	"	8,000
Lewis A. Kinney,	North Norwich Brook,	Smyrna and N. Norwich,	"	8,000
Joseph Cammer,	Beaverkill River,	Rockland,	Sullivan,	10,000
Joseph A. Peaslee,	McKean Creek,	Cherry Valley,	Otsego,	5,000
W. S. Russell, Secretary,	Various streams,	Otsego, Middlefield and Hartwick,	"	15,000
E. B. Wells,	Bogans Brook,	Augusta and Madison,	Oneida and Madison.	5,000
"	Various streams,	Madison,	" "	8,000
Wawaka Fish Club,	Round Top Mountain Brook,	Roxbury,	Delaware,	10,000
Frank B. Potter,	Various streams,	Chester,	Warren,	20,000
William H. Robinson,	Little Chazy River,	West Chazy,	Clinton,	10,000
W. W. Straight,	Spring Brook,	Wheatland,	Monroe,	3,000
James McCormick,	Lewey Lake,	Lake Pleasant,	Hamilton,	15,000
Isaiah Perkins,	Mason Lake,	"	"	25,000
Charles Edkins,	West Branch Chenango River,	Hamilton and Lebanon,	Madison,	8,000
W. W. Aldrich, M. D.,	Siamese Ponds,	Johnsburgh,	Warren,	15,000

DISTRIBUTION OF BROOK TROUT FRY.—CONTINUED.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
W. Whitehouse,	Run Brook, etc.,	Greenburg,	Westchester,	10,000
Claude Carroll,	Various streams,	Avoca,	Steuben,	20,000
Edward Ham,	"	Stamford,	Dutchess,	15,000
H. P. Denison,	Butternut Creek,	Dewitt,	Onondaga,	8,000
L. F. Briggs,	Powel's Brook,	Eaton and Lebanon,	Madison,	8,000
W. A. Parker,	Wylie and Wilkins Brooks,	Coventry,	Chenango,	8,000
E. W. Terrill,	Otselic Creek, etc.,	Pitcher,	"	5,000
Louis Will,	Various streams,	Fabius, Delhi, Cardiff and Geddes,	Onondaga,	10,000
George B. Reynolds,	Rondout streams,	Neversink,	Sullivan,	10,000
George Carver,	Various streams,	Huron, Wolcott, Arcadia and Sodus,	Wayne,	10,000
Dr. H. M. Lincoln,	"	Wilton and Moreau,	Saratoga,	10,000
E. F. Galligan,	Tonawanda Creek,	Weathersfield,	Wyoming,	5,000
Howard Tillotson,	W. Branch Mongaup,	Bethel,	Sullivan,	15,000
J. W. Parker,	Kings Church Brook,	Cambridge and Schaghticoke,	Washington and Rensselaer,	5,000
George A. McCoy,	Little Tupper Lake,	Long Lake,	Hamilton,	25,000
C. H. Weidner,	Bushkill,	Olive,	Ulster,	10,000
J. E. Leonard, M. D.,	Owego Creek, etc.,	Harford, La Pierre and Richford,	Tioga and Cortland,	10,000
E. O. Eldredge,	E. Branch Owego Creek, etc.,	Berkshire and Richford,	Tioga,	10,000
F. J. Shattuck,	Cherry Creek, etc.,	Cherry Creek,	Chautauqua,	10,000
Dr. C. E. Fritz et al.,	Various streams,	Livingston, Claverack and Greenport,	Columbia,	15,000
J. E. Board,	Salisbury Brook, etc.,	Blooming Grove,	Orange,	10,000
Howard M. Durant,	Big Forked Lake,	Long Lake,	Hamilton,	15,000

DISTRIBUTION OF BROOK TROUT FRY.—CONTINUED.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Henry French,	Wolf Run Creek,	Echo,	Cattaraugus,	5,000
William Casey,	Various streams,	Columbus,	Chenango,	8,000
Samuel H. Norton,	"	Delhi,	Delaware,	25,000
Beatty S. Morrill,	Ostrander Brook, etc.,	Plattsburgh,	Clinton,	10,000
"	Mead Brook,	"	"	10,000
H. R. Murray,	Oakhill Creek,	Lenox,	Madison,	8,000
F. M. Dodge,	Mongaup and tributaries,	Liberty,	Sullivan,	10,000
Charles V. Messiter,	Fisk and Young Brooks,	"	"	10,000
U. S. Messiter,	Briton Hollow Brook,	"	"	10,000
J. K. Kirnan,	Crystal Brook,	Forestport,	Oneida,	5,000
Frederick D. Jones,	Dudley Creek, etc.,	Lisle and Richford,	Broome and Tioga,	8,000
Charles I. Telford,	East Branch,	Meredith,	Delaware,	5,000
John W. Holt,	Cat Tail Brook,	Liberty,	Sullivan,	8,000
F. M. Bouck,	Martin Brook,	Colesville,	Broome,	8,000
Charles M. Heidt,	Callicoon Creek, etc.,	Callicoon and Delaware,	Sullivan,	8,000
George A. Daniels,	Chase Brook,	Pawling,	Dutchess,	5,000
W. A. Shapley,	Bradley Brook,	Lebanon,	Madison,	8,000
L. F. Bennett,	East Branch, Neversink,	Denning,	Ulster,	12,000
J. W. Coughtry,	Martins Creek, etc.,	New Scotland,	Albany,	8,000
Casper W. Baher,	York Brook,	Peru and Ausable,	Clinton,	10,000
J. K. Grant,	Various streams,	Jefferson, Stamford and Harpersfield,	Delaware and Sullivan,	20,000
John Sayer,	Demerest Brook,	Warwick,	Orange,	4,000
D. H. Hull,	Various streams,	Petersburgh,	Rensselaer,	10,000
T. J. Eldredge,	"	Minerva,	Essex,	10,000
Burt P. Sperry,	"	Caton and Hamilton,	Madison,	8,000
Alvin Winslow,	Willcox and New Lakes,	Stony Creek,	Warren,	15,000

DISTRIBUTION OF BROOK TROUT FRY.—CONTINUED.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Avery L. Foote,	East Palmyra Spring Brook,	East Palmyra,	Wayne,	3,000
William H. Lawrence,	Callicoon Creek, etc.,	Delaware and Callicoon,	Sullivan,	10,000
Edward Barnes,	Mongaup,	Lumberland,	"	20,000
W. D. Stevenson,	Moses Kill,	Argyle,	Washington,	10,000
Theron O. Brown,	Various streams,	Taylor,	Cortland,	5,000
David Kisselbrach,	Tributaries to Roliff,	Ancram,	Columbia,	10,000
James B. Smith,	Various streams,	Neversink,	Sullivan,	10,000
R. M. Rush,	Mad River, etc.,	Camden,	Oneida,	10,000
William H. Post,	Various streams,	Newburgh and Cornwall,	Orange,	8,000
George M. Weed,	"	Wassaic,	Dutchess,	8,000
Amos Huntley,	Canasawatka, etc.,	Pharsalia, Plymouth and Norwich,	Chenango,	5,000
R. J. Fitz Maurice,	Various streams,	Java,	Wyoming,	8,000
R. A. Woodruff, President,	Squampomac Creek,	Ghent, Claverack and Hillsdale,	Columbia,	15,000
A. Cline,	Barlow Brooks, etc.,	South Armenia,	Dutchess,	5,000
C. W. Van Brocklin,	Various streams,	Worth,	Jefferson,	15,000
John S. Bauer,	Mud Creek,	Salina, Clay and Cicero,	Onondaga,	5,000
George W. Kelley,	Meeker Hollow streams,	Roxbury,	Delaware,	10,000
R. J. Warren,	Pleasant Brooks, etc.,	Roseboom,	Otsego,	8,000
Frederick Klosner,	Various streams,	Highmarket,	Lewis,	15,000
Charles E. Taylor,	White and Sugar Rivers,	West Turin,	"	10,000
M. B. Streeter,	Little Hoosick, etc.,	Berlin,	Rensselaer,	15,000
W. H. McGrath,	Steele Brook,	Rockland,	Sullivan,	10,000
F. W. Hartig,	Hardenburgh Brook,	"	"	15,000
Jay Davidson,	Beaverkill River, etc.,	"	"	8,000
Margaret Davis,	West Branch Unadilla River,	Bridgewater,	Oneida,	8,000

DISTRIBUTION OF BROOK TROUT FRY.—CONTINUED.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Frederick A. Holmes,	Round Lake and Deer Pond,	Forestport,	Oneida,	8,000
E. R. Eaton, M. D.,	Various streams,	Crown point,	Essex,	10,000
J. C. Brevort,	Trout Brook,	"	"	10,000
Frank D. Hamilton, President,	Various streams,	Nelson,	Madison,	10,000
A. M. Russell, President,	Headwaters, Chenango River,	Hamilton,	"	8,000
W. H. Scudder,	Beaverkill River,	Rockland,	Sullivan,	5,000
Frederick Clayton,	Shin Creek,	"	"	5,000
J. D. Davidson,	Shin Creek and Beaverkill,	"	"	8,000
E. R. Sprague,	Race Brook and Beaverkill,	"	"	8,000
John M. Bussey,	Shin Creek,	"	"	5,000
J. D. Joslin,	West Owego Creek,	Newark Valley,	Tioga,	10,000
W. C. Pierce,	Owego Creek, etc.,	Richford,	"	8,000
J. Fleming,	East Owego Creek,	"	"	8,000
Beckley Howes,	West Branch Wescry Creek,	Eagle and Withersfeld,	Wyoming,	8,000
W. C. E. Brimmer, Secretary,	White Creek,	WhiteCreek and Hoosick,	Washington and Rensselaer,	10,000
Timothy Lean,	Stony Brook,	Franklinville and Humphrey,	Cattaraugus,	10,000
J. M. Wardner,	Rainbow Lake and Clear Pond,	Franklin and Brighton,	Franklin,	25,000
W. C. E. Brimmer, Secretary,	West Hoosick stream,	Hoosick and Pittstown,	Rensselaer,	10,000
" " "	Shingle Hollow Brook,	Grafton and Hoosick,	"	8,000
Jacob H. Hoysradt,	Belcher stream,	Ancram,	Columbia,	10,000
F. E. Schenck,	Tributaries Fulton Chain Lakes,	Webb,	Herkimer,	15,000
S. G. Prime,	Various streams,	Jay,	Essex,	20,000
Cassius Winch,	"	Wilmington,	"	10,000
A. J. Thompson,	Cherry Valley, etc.,	Cherry Valley,	Otsego,	8,000
William Rutherford,	Trout Brook,	Potsdam, Madrid and Norfolk,	St. Lawrence,	10,000

DISTRIBUTION OF BROOK TROUT FRY.—CONTINUED.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Amos M. Johnson,	Bull Creek,	Triangle,	Broome,	8,000
John Fisher,	Gilman Lake,	Lake Pleasant,	Hamilton,	20,000
Thomas H. Hearn,	Tributaries Cherry Valley Creek,	Middlefield,	Otsego,	8,000
William H. Baker,	Mongaup River, etc.,	Thompson and Liberty,	Sullivan,	20,000
Milo E. Bull,	Johns Lake and Eagle Creek,	Webb,	Herkimer,	15,000
J. W. Hutton,	Upper Chateaugay Lake,	Dannemora,	Clinton,	15,000
Sandy Hill Fish and Game Club,	Miller and Cold Brooks,	Kingsbury,	Washington,	15,000
W. F. Stimpson,	Sands Creek,	Hancock,	Delaware,	8,000
H. H. Covey,	Big Moose and other waters,	Webb,	Herkimer,	20,000
David Frink,	Cold Brook,	Pharsalia and Plymouth,	Chenango,	5,000
D. J. Doughty, Secretary,	Trout streams,	Naples,	Ontario,	10,000
John A. Roberts,	South Lake,	Wilmurt,	Herkimer,	20,000
George H. Davis,	Tributaries E. Branch Unadilla,	Litchfield,	"	8,000
William A. Miles,	Various streams,	Copake,	Columbia,	10,000
J. D. Bell,	"	Hillsdale and Copake,	"	8,000
G. D. Langdon,	Bashbish Falls,	Copake,	"	8,000
Jacob S. Barnett,	Eureka Stream,	"	"	8,000
T. B. Keating,	Cedar Brook,	"	"	5,000
H. J. Fuller,	Laird Brook,	Castile and Genesee,	Wyoming,	5,000
George I. Treyz,	Russell and Cooks Brooks,	Colchester,	Delaware,	8,000
Charles Herring,	Various streams,	Walton,	"	25,000
C. B. May,	"	Hancock,	"	20,000
George W. Jones,	Baxter Brook, etc.,	"	"	8,000
William Winter,	Various streams,	Delhi,	"	25,000
J. E. Cassidy,	Trout brook,	Hancock,	"	8,000
J. G. Stevens,	Various streams,	Rockland,	Sullivan,	15,000
G. W. Harding,	Mongaup and tributaries,	Liberty,	"	15,000

DISTRIBUTION OF BROOK TROUT FRY.—CONTINUED.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
G. S. Knapp,	Various streams,	Fallsburgh,	Sullivan,	10,000
Ellsworth Leroy,	Neversink River, etc.,	"	"	15,000
I. Post,	Middle Mongaup Stream,	Liberty Falls,	"	10,000
Samuel S. Wakeman,	Ellis Creek, etc.,	Milton and Saratoga Springs,	Saratoga,	10,000
J. W. Shepardson,	Various streams,	Smyrna,	Chenango,	10,000
Robert Hurd,	Hurd's Corners Brook,	Pawling,	Dutchess,	5,000
William R. Lee,	Village Stream,	"	"	5,000
G. F. Lee,	Dodge Stream,	"	"	5,000
C. M. Bennett,	Various streams,	Webb,	Herkimer,	10,000
J. E. Pond,	Black Brook,	North Hudson,	Essex,	10,000
Prof. H. J. Shaw,	Great and Shawler,	New Berlin,	Chenango,	10,000
H. F. Whittenhall,	Wheeler Brook, etc.,	Green,	"	10,000
W. E. Griffiths, M. D.,	Kinne Brook, etc.,	Thompson,	Sullivan,	15,000
R. P. Town,	Nigger Brook,	Franklin,	Franklin,	10,000
S. W. Barnard,	Lyon Brook,	"	"	10,000
Seth Wardner,	Summer Brook,	"	"	10,000
John W. Fletcher,	Cold Brook,	"	"	10,000
E. D. White,	Moose Lake,	St. Armand,	Essex,	10,000
Howland F. Titus,	Slide Brook,	"	"	10,000
W. H. Phillips, Secretary,	Various streams,	Bath and others,	Steuben,	40,000
William W. Stevens,	Windfall Pond,	Webb,	Herkimer,	10,000
William Dart,	Second Lake, North Branch,	"	"	25,000
H. N. Burhans,	Bishops Brook, etc.,	Manlius,	Onondaga,	5,000
M. W. Robbins,	Whiskey Creek and branches,	Corning and Caton,	Steuben,	4,000
H. G. Sammis,	Primes Brook,	Huntington,	Suffolk,	10,000
J. H. Higby,	Big Moose Lake, etc.,	Webb,	Herkimer,	10,000

DISTRIBUTION OF BROOK TROUT FRY.—CONTINUED.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
William H. Brooks,	Two Ponds Brook,	Highlands,	Orange,	5,000
Thomas Flynn,	Willoemoe and Mongaup,	Rockland,	Sullivan,	8,000
Parish Fish and Game Association,	Various streams,	Parish,	Oswego,	10,000
Charles W. Griswold,	LeRoy Creek,	Freemont and Hornellsville,	Steuben,	4,000
G. S. Van Gorder,	Wiscoy and tributaries,	Pike,	Wyoming,	8,000
E. J. Wheeler,	West Branch Wiscoy Creek,	Eage,	"	8,000
W. L. Loomis,	Sanquoit Creek,	Paris,	Oneida,	8,000
Frank Banton,	Shekomeko Trout Stream,	Pine Plains,	Dutchess,	8,000
Martin Lobdell,	Beckwith,	Schuyler Falls,	Clinton,	10,000
D. S. Merrill,	Upper Chateaugay Lake,	Ellenburgh and Dannemora,	"	10,000
W. M. Peck,	Hagadorn Creek,	Providence,	Saratoga,	8,000
L. M. Howes,	Salmon River,	Peru,	Clinton,	10,000
William C. Edmonston,	Humphreys Brook,	Phelps,	Ontario,	4,000
Peter Flint,	Various streams,	Ticonderoga,	Essex,	8,000
Charles F. Wait,	Mosherville Creek,	Galway,	Saratoga,	10,000
R. H. Canfield,	Crandall Brook,	Mamakating,	Sullivan,	10,000
J. W. Starks,	Smithwood Brook,	Altona,	Clinton,	5,000
"	Sample Brook,	"	"	5,000
"	Great Chazy River,	"	"	8,000
H. A. Starks,	"	"	"	8,000
Charles E. Quick,	Callicoon stream,	Callicoon,	Sullivan,	5,000
J. E. Reed,	Thirsty Pond,	Webb,	Herkimer,	10,000
David French, Jr.,	Steuben Creek, etc.,	Trenton,	Oneida,	8,000
C. T. Leland,	Various streams,	Schroon,	Essex,	20,000
George A. Stevens,	"	North Elba,	"	30,000

DISTRIBUTION OF BROOK TROUT FRY.—CONTINUED.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
David Douglas,	Various streams,	Black Brook,	Clinton,	15,000
W. J. Watson,	Trout Brook,	Scott,	Cortland,	5,000
G. R. Easton,	Crystal Creek,	Watson and New Bremen,	Lewis,	8,000
Fisheries, Game and Forest Com.,	Seventh Lake, Fulton Chain,	Morehouse,	Hamilton,	10,000
" "	Eight Lake,	"	"	10,000
" "	Twitchell Lake,	Webb,	Herkimer,	5,000
" "	Buck Pond,	"	"	5,000
" "	Middle Branch, Moose River,	"	"	5,000
Walter E. Blackall,	Plum Brook,	Stillwater,	Saratoga,	10,000
D. I. Roberts,	Gray Court Creek,	Chester,	Orange,	5,000
Fisheries, Game and Forest Com.,	Ten-Mile River,	Tusten,	Sullivan,	5,000
D. I. Roberts,	Trout Stream,	Lordville,	Delaware,	8,000
Seward Merry,	Steel's Creek,	Litchfield and German Flats,	Herkimer,	8,000
Fisheries, Game and Forest Com.,	Streams at Sacandaga Hatchery,	Lake Pleasant,	Hamilton,	10,000
W. L. Mead,	Nash Brook, etc.,	Dannemora and Saranac,	Clinton,	15,000
W. J. Alfred,	Brown's Pond,	Waverly,	Franklin,	10,000
W. A. Fullerton,	Trout Brook,	Santa Clara,	"	10,000
D. N. Riddle,	Various ponds,	"	"	50,000
Orlando Kellogg,	Boquet River, etc.,	Elizabethtown,	Essex,	15,000
Fisheries, Game and Forest Com.,	Little Clear Pond,	Santa Clara,	Franklin,	15,000
" "	Big Clear Pond,	Harristown,	"	35,000
" "	East Inlet, Nicks Lake,	Webb,	Herkimer,	5,000
Paul Smith's Hotel Co.	Lower St. Regis Lake,	Brighton,	Franklin,	25,000
H. R. Phillips,	Potter Stream,	Potter and Jerusalem,	Yates,	5,000
E. A. Sprague,	Cleodoig headwaters,	Springwater,	Livingston,	5,000
Fisheries, Game and Forest Com.,	Cold Spring Brook,	Webb,	Herkimer,	5,000

DISTRIBUTION OF BROOK TROUT FRY.—Continued.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Fisheries, Game and Forest Com.,	Carry Pond Brook,	Webb,	Herkimer,	5,000
" "	Indian Spring, Cold Brook,	"	"	10,000
" "	Joy's Spring Brook,	"	"	10,000
" "	Buell Beaver Meadow Brook,	"	"	5,000
" "	Big Spring Hole Brook,	"	"	10,000
" "	Third Lake Creek,	"	"	5,000
" "	Cameron's Brook,	Urbana,	Steuben,	5,000
" "	Glen Brook,	"	"	5,000
" "	Abbott's Brook,	"	"	5,000
" "	Eggleston Brook,	Milo,	Yates,	5,000
" "	Ray Brook,	North Elba,	Essex,	15,000
" "	Two-Bridge Brook,	Harrietstown,	Franklin,	5,000
" "	Fay Brook,	"	"	10,000
" "	Ricketson Brook,	Franklin,	"	10,000
" "	Bone Pond,	Santa Clara,	"	5,000
" "	Grass Pond,	Santa Clara and Harrietstown,	"	5,000
" "	St. Regis Pond,	Santa Clara,	"	5,000
" "	Colby Pond,	Harrietstown,	Franklin,	5,000
" "	Hawley Creek,	Wells,	Hamilton,	10,000
" "	Brown Creek,	Lake Pleasant,	"	10,000
" "	Elbow Creek,	Wells,	"	10,000
" "	Cherry Creek,	Lake Pleasant,	"	15,000
" "	Little Moose Landing Creek,	Webb,	Herkimer,	5,000
" "	Hellgate Lakes,	"	"	10,000
" "	Outlet Bald Mountain Pond,	"	"	5,000
" "	Harrison's Creek,	"	"	10,000

DISTRIBUTION OF BROOK TROUT FRY.—CONCLUDED.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
D. M. Roberts,	Tributaries Grass Pond,	Franklin,	Franklin,	3,000
Fisheries, Game and Forest Com.,	Derber Brooks, etc.,	Rockland,	Sullivan,	15,000
" "	Independence Lake,	Webb,	Herkimer,	5,000
" "	Middle Branch Moose River,	"	"	5,000
" "	Lower Hellgate Lake,	"	"	10,000
W. M. Spurge,	Nissequogue River,	Smithtown,	Suffolk,	15,000
Fisheries, Game and Forest Com.,	Outlet Little Clear,	Santa Clara,	Franklin,	5,000
" "	Spring Brook,	Colchester,	Delaware,	8,000
" "	Beaverkill River, etc.,	Rockland,	Sullivan,	8,000

DISTRIBUTION OF BROOK TROUT FINGERLINGS.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
F. D. Kilburn,	Indian Lake and Salmon River,	Belmont,	Franklin,	1,000
Edward Thompson,	Nissequogue River,	Smithtown,	Suffolk,	5,000
Fisheries, Game and Forest Com.,	Beaver River,	Webb,	Herkimer,	4,000
" "	North Branch Moose River,	"	"	900
W. J. Maxwell,	Dugan Creek,	Caledonia,	Livingston,	1,000
Fisheries, Game and Forest Com.,	Headwaters Cohocton River,	Cohocton and Wayland,	Steuben,	500
" "	Spring Brook,	Cohocton,	"	500
" "	Stocking Run,	Bath and Cameron,	"	500
" "	Goff's Creek,	Avoca and Howard,	"	1,000
" "	Outlet Little Clear,	Santa Clara,	Franklin,	1,800
W. B. Dunlap,	Various streams,	Perth and Amsterdam,	Fulton and Montgomery,	500

DISTRIBUTION OF BROOK TROUT FINGERLINGS.—CONTINUED.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Fisheries, Game and Forest Com.,	Beaverkill and Shin Creek,	Rockland,	Sullivan,	3,000
" "	Willoemoe River,	"	"	3,000
" "	Neversink River,	Neversink,	"	2,000
Edward I. Rice,	Green Lake,	Dewitt,	Onondaga,	1,000
W. W. Suits,	White Bottom Brook,	Memphis,	"	1,500
Fisheries, Game and Forest Com.,	Little Clear Pond,	Santa Clara,	Franklin,	1,000
" "	Big Clear Pond,	"	"	1,000
" "	Third Lake, Fulton Chain,	Webb,	Herkimer,	2,000
" "	New Hampshire Commission,	New Hampshire Com.,	. . .	100
" "	Little Trout Pond,	Moriah,	Essex,	3,900
Salamanca Gun and Rod Club,	Ten-Mile Creek,	Carrollton,	Cattaraugus,	3,000
" "	Drake Run Creek,	Salamanca,	"	2,000
" "	Christian Creek,	Great Valley,	"	3,000
W. E. Wolcott, Secretary, etc.,	Various streams,	Remsen, Trenton, etc.,	Oneida,	10,000
E. D. Keeney,	Flynn and Clear Creeks,	Arcade,	Wyoming,	3,000
Burt B. Lewis,	Shin Lake Stream, etc.,	Freedom,	Cattaraugus,	3,000
Bechley Howes,	West Branch Wiscoy Creek,	Eagle and Nethersfeld,	Wyoming,	5,000
A. O. Fitch,	Warner and Nichols Brooks,	Yorkshire,	Cattaraugus,	2,000
A. H. Fowler,	Six-Mile Creek, etc.,	Ithaca,	Tompkins,	5,000
A. S. Rowley,	Griffin Creek,	Cuba,	Allegany,	4,000
Herman S. Mase,	Whortlekill Brook,	Hopewell,	Dutchess,	2,000
A. V. Rockwell,	Clove Creek,	Fishkill,	"	2,000
C. M. Williams,	Various streams,	Boliver, etc.,	Allegany and Cattaraugus,	6,000
Charles A. Ball,	"	Wellsville, Willing, etc.,	Allegany,	5,000
W. D. Snell,	Big Brook, etc.,	Worth,	Jefferson,	2,000
W. R. Stephens,	N. Branch, Twenty-Mile Creek,	Ripley,	Chautauqua,	300

DISTRIBUTION OF BROOK TROUT FINGERLINGS.—CONCLUDED.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
—— ——	Dugan Creek,	Caledonia,	Livingston,	1,000
G. S. Van Gorder,	Wiscoy Creek,	Pike,	Wyoming,	2,500
T. M. Costello,	Penoyer Brook, etc.,	Albion and Orwell,	Oswego,	4,500
T. B. Tutle,	Oatka or Allan Creek,	Le Roy,	Genesee,	2,500
J. E. Pond,	Black Brook,	North Hudson,	Essex,	2,000
G. C. Lewis,	Streams,	Potsdam,	St. Lawrence,	1,000
George B. Smith,	Sing Sing Creeks, etc.,	Horseheads and Big Flats,	Chemung.	500
Charles L. Guy,	Various streams,	Elizabethtown,	Essex,	2,000
Marcein Skinner,	"	Mamakating,	Sullivan,	1,000
D. I. Roberts,	Peaks and Adams Brooks,	Long Eddy,	"	1,000
"	Cuddeback Brook, etc.,	Deer Park,	Orange,	1,500
"	Various streams,	Cochecton,	Sullivan,	1,000
W. L. Brown,	Cold Spring Brook,	Oneonta,	Otsego,	1,000
George H. Bancroft,	Cranberry Lake,	Clifton,	St. Lawrence,	3,000
W. A. Wells,	Sprout Creek,	La Grange,	Dutchess,	1,000
O. Finch,	Bess Lock Outlet,	Ancram,	Columbia,	1,000

DISTRIBUTION OF BROOK TROUT YEARLINGS.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
J. O. Ballard,	Indian Lake, etc.,	Belmont,	Franklin,	1,000
Charles S. Nesbit,	Various streams,	Providence and Northampton,	Saratoga and Fulton,	800
Barkley S. Marsh,	Hollyglot Brook, etc.,	Deer Park,	Orange,	1,000
Salamanca Gun and Rod Club,	Willoughby Creek,	Great Valley,	Cattaraugus,	500
William H. Bartlett,	Mead and Peters Brooks,	Amenia,	Dutchess,	500
Olean Sportsmen's Club,	Various streams,	Olean,	Cattaraugus,	200
Ira S. Smith,	Wawayanda Creek,	Warwick,	Orange,	500
Minot S. Mitchell,	Dark Hollow Brook,	Smyrna, Plymouth and N. Norwich,	Chenango,	100
Sherburne Fish and Game Association,	Various streams,	Sherburne,	"	100
Frederick Mitchell,	Titus,	North Norwich,	"	100
B. L. Crandall,	Canasawatka Creek,	Pharsalia, Plymouth, etc.	"	100
George W. Little,	Tributaries to Wallkill,	Montgomery,	Orange,	400
R. Christian,	Backus Brook,	Elizabethtown,	Essex,	500
Fisheries, Game and Forest Com.,	Spring Creek,	Caledonia,	Livingston,	7,000
W. E. Wolcott, Secretary,	Various streams,	Remsen, Trenton, etc.,	Oneida,	1,000
Saratoga Fish and Game Club,	Bog Meadow Brook,	Saratoga Springs,	Saratoga,	500
H. M. Carpenter,	Height's Pond and Brook,	Goshen,	Orange,	1,000
P. H. Willey,	Little Mill Creek,	Spraguetown and Livingston,	Livingston,	250
Cyrus Durey,	Caroga Creek, etc.,	Caroga,	Fulton,	100
J. W. Shepardson,	Pleasant and Ackley Brooks,	Smyrna,	Chenango,	100
H. F. Whittenhall,	Wheeler and Crandall Brooks,	Greene,	"	200
Parish Fish and Game Association,	Various streams,	Parish,	Oswego,	500
E. E. Ford,	Otego and Charlotte Creeks,	Otsego,	Otsego,	800
Abram J. Miller,	Tributaries Croton River,	Brewster,	Putnam,	600

DISTRIBUTION OF BROOK TROUT YEARLINGS.—CONCLUDED.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Charles A. Ball,	Various streams,	Wellsville, Willing, etc.,	Allegany,	250
George A. Stevens,	Lake Placid and Mirror Lake,	North Elba,	Essex,	1,000
H. S. Holden,	Onondaga Creek,	. . . . . .	Onondaga,	800
John Hyland,	Headwaters, Cohocton River,	Springwater,	Livingston,	1,000
Fisheries, Game and Forest Com.,	Spaulding Creek,	Bath,	Steuben,	1,000
" "	Stocking River,	Bath and Cameron,	"	1,000
" "	Moose River, etc.,	Webb,	Herkimer,	1,000
" "	Big Moose Lake,	"	"	1,400
" "	Allen's Creek,	Brighton,	Monroe,	250
" "	Lower Saranac Lake,	Harrietstown,	Franklin,	1,000
B. F. Vail,	Various streams,	Norwich,	Orange,	1,000
E. O. Eldredge,	Owego and Wilson,	Berkshire and Rickford,	Tioga,	250
Fisheries, Game and Forest Com.,	Breeding Ponds (18 mos. old),	Webb,	Herkimer,	480
" "	Spring Creek, (18 mos. old),	Caledonia,	Livingston,	400
" "	Onondaga Creek (adults),	. . . . . .	Onondaga,	22
C. H. Babcock,	Irondequoit Creek,	Brighton,	Monroe,	1,000
J. E. Bierhardt, Secretary,	Onondaga Creek,	Onondaga and Lafayette,	Onondaga,	1,000
W. C. Witherbee,	Munson and Bloody Ponds,	North Hudson,	Essex,	300
Salamanca Gun and Rod Club,	Breed Run Creek,	Red House,	Cattaraugus,	500

DISTRIBUTION OF BROWN TROUT FRY.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Frank H. Wager et al.,	Deepkill Creek,	Schaghticoke,	Rensselaer,	5,000
M. S. Grow,	Flint Creek, etc.,	Italy,	Yates,	5,000
E. L. Fisher, Secretary,	Black Creek,	Bergen,	Genesee,	10,000
J. Simpson,	Garbert's Pond,	Garbert,	Monroe,	5,000
David H. Haight,	Rose Mill Creek,	Montgomery,	Orange,	10,000
De Ruyter Sportsmen's Club,	Tioughnioga River, etc.,	De Ruyter,	Madison,	25,000
John T. Lynch,	Miamus River,	Bedford,	Westchester,	10,000
H. C. Allen,	Headwaters Otselic Creek,	Georgetown,	Madison,	15,000
F. W. Abrams,	Piseco Lake,	Arietta,	Hamilton,	15,000
E. D. Crosley,	Various waters,	Spofford, Scott, etc.,	Onondaga and Cortland,	10,000
Oliver Velzy,	Spring Brook and Clear Creek,	Brant,	Erie,	5,000
David Tice,	Eighteen-Mile Creek, etc.,	Royalton, Lockport, etc.	Niagara,	5,000
Salamanca Gun and Rod Club,	Bee Hunter Creek,	Red House,	Cattaraugus,	8,000
" "	Bouvey Creek,	"	"	8,000
" "	Stoddard Creek,	"	"	8,000
W. H. Walker,	Christie's Mill Pond,	Caledonia,	Livingston,	2,000
Will Osborn,	Lake Pleasant,	Lake Pleasant,	Hamilton,	10,000
Olean Sportsmen's Club,	Various streams,	Olean,	Cattaraugus,	20,000
J. D. Parker,	Middle Otselic River,	Otselic,	Chenango,	15,000
John McNeil,	Deer River and tributaries,	Santa Clara,	Franklin,	15,000
Ira Elmendorf,	Esopus Creek,	Olive,	Ulster,	15,000
Erastus Stafford,	Stafford and Arnold Brooks,	Ausable,	Clinton,	10,000
H. E. Heyworth,	Calkin and Dillon Brooks,	Peru,	"	10,000
Addison McIntyre,	Mill Brook,	Lake Pleasant,	Hamilton,	7,000
Grawsline Club,	Grasse River,	Colton,	St. Lawrence,	25,000
E. A. Dox,	Cobleskill,	Richmondville,	Schoharie,	10,000

DISTRIBUTION OF BROWN TROUT FRY.—CONTINUED.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
F. E. Sanborn,	Little Ausable River,	Peru,	Clinton,	5,000
Willis Johnson,	Onesquithaw,	New Scotland,	Albany,	5,000
Ahira Green,	Lake,	Colchester,	Delaware,	8,000
James C. Sturges,	Pilsbury Lake,	Arietta,	Hamilton,	8,000
Albert Danforth,	Whitney Lake,	"	"	8,000
Judson Newman Smith,	Big Trout Pond,	Atherton,	St. Lawrence,	10,000
Minot S. Mitchell,	Skinner Brook,	Norwich and N. Norwich,	Chenango,	5,000
C. H. Furness,	Various streams,	Bleecker, Mayfield, etc.,	Fulton,	20,000
B. F. Gladding,	Otselic Creek,	Several towns,	Chenango,	10,000
B. L. Crandall,	Canasawasta Creek,	Pharsalia, etc.,	"	8,000
Lewis A. Kinney,	North Norwich Brook,	Smyrna and N. Norwich,	"	8,000
D. A. Devendorf,	Various streams,	Galway,	Saratoga,	15,000
W. S. Russell, Secretary,	"	Springfield,	Otsego,	15,000
Mercien Skinner,	Bashakill,	Mamakating,	Sullivan,	15,000
James McCormick,	Lewey Lake,	Lake Pleasant,	Hamilton,	5,000
C. H. Wilcox,	Branches Chenango River.	Hamilton, Lebanon, etc.,	Chenango,	10,000
Dennis M. Coe,	Moose and Black Rivers,	Lyonsdale,	Lewis,	5,000
E. W. Terrill,	Otselic Creek, etc.,	Pitcher,	Chenango,	5,000
George Carver,	Various streams,	Huron, Wolcott, etc.,	Wayne,	10,000
George A. McCoy,	Little Tupper Lake,	Long Lake,	Hamilton,	20,000
Edward L. Mitchell,	Dunbar Hollow Creek,	Westerloo,	Albany,	5,000
Frank Sherman,	Mead Creek,	Caroga,	Fulton,	10,000
J. W. Hutton,	Upper Chateaugay Lake,	Lyon Mountain,	Clinton,	15,000
H. L. Kreader,	Nanuet,	Clarkstown,	Rockland,	3,000
Herman Otto,	Baxter Brook,	Mount Hope,	Orange,	5,000
A. T. Beishoff,	Little Shawangunk Kill,	Wallkill,	"	10,000
A. E. Nickinson,	Baxter Brook,	Mt. Hope,	"	5,000

DISTRIBUTION OF BROWN TROUT FRY.—CONTINUED.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
A. L. Decker,	Shawangunk Kill,	Mt. Hope,	Orange,	5,000
Louis Roth,	Beaver Brook,	"	"	10,000
H. M. Hayes,	Binnewater,	Greenville,	"	10,000
John Wilkin,	Nitkill Brook,	Wallkill and Mt. Hope,	"	10,000
W. D. Stevenson,	Summit Lake, etc.,	Argyle,	Washington,	10,000
Theron O. Brown,	Pond Brook,	Taylor,	Cortland,	5,000
John A. Manzine,	Beaver and Bog Brooks,	North Salem,	Washington,	5,000
William G. Arnold,	Sawmill River,	Mt. Pleasant,	Westchester,	10,000
E. R. Eaton, M.D.,	Putts Creek,	Crown Point,	Essex,	10,000
Frank D. Hamilton, President,	Various streams,	Nelson,	Madison,	10,000
A. M. Russell, President,	Headwaters Chenango River,	Hamilton,	"	12,000
W. C. E. Brimmer, Secretary,	Walloomsack Stream,	Hoosick,	Rensselaer,	10,000
S. G. Prime,	Various streams,	Jay,	Essex,	5,000
Cassius Winch,	Cold Spring Pond, etc.,	Wilmington,	"	20,000
George Cecil,	Sucker and Mill Brooks,	Horicon,	Warren,	15,000
L. B. Ruttenber,	Headwaters Conewango Creek,	Villenora,	Chautauqua,	10,000
Charles Ketcham,	Various streams,	Cornwall	Orange,	3,000
Honeoye Falls Anglers' Association,	Durham Brook,	Bloomfield,	Ontario,	5,000
P. A. Purdy, Secretary,	Various streams,	Smithville,	Chenango,	10,000
Cyrus Durey,	Caroga Creek, etc.,	Caroga,	Fulton,	10,000
Moses F. Nelson,	Buttermilk Falls Brook,	Highland Falls,	Orange,	8,000
F. M. Robinson,	Cutler Brook,	Dover,	Dutchess,	5,000
W. H. Phillips, Secretary,	Campbell Creek,	Bath and Canisteo,	Steuben,	5,000
Rowland Wilson,	Fish Creek,	Annsville,	Oneida,	20,000
Charles W. Griswold,	Leroy Creek,	Freemont and Hornellsville,	Steuben,	4,000
Charles W. Backus,	Upper Chateaugay Lake,	Ellenburgh and Dannemora,	Clinton,	10,000

DISTRIBUTION OF BROWN TROUT FRY.—Concluded.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
William H. Shear,	Hannecroix Creek,	Coyemans and Westerloo,	Albany,	3,000
Peter Flint,	Buck Mountain Pond,	Ticonderoga,	Essex,	5,000
W. J. Watson,	Cold Brook,	Homer,	Cortland,	5,000
George W. Dustin,	Little Salmon River, etc.,	Moira,	Franklin,	10,000
Fisheries, Game and Forest Com.,	Beaverkill River,	Rockland,	Sullivan,	12,000
D. I. Roberts,	Medina Creek,	Woodbury,	Orange,	5,000
"	Silver Stream, etc.,	Blooming Grove,	"	5,000
"	Knight's Creek, etc.,	Hancock,	Delaware,	5,000
"	Various streams,	Deposit,	Broome,	5,000
Fisheries, Game and Forest Com.,	Roily Pond,	Santa Clara,	Franklin,	5,000
" "	Little Long Pond,	"	"	10,000
" "	Outlet Little Clear Pond,	"	"	10,000
" "	Little Green Pond,	"	"	30,000
D. I. Roberts,	Woodbury,	Woodbury,	Orange,	5,000

DISTRIBUTION OF BROWN TROUT FINGERLINGS.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
F. T. Huxley,	Tributaries of Black Brook,	Providence, North'mpton and Broadalbin,	Saratoga and Fulton,	1,000
F. D. Kilburn,	Indian Lake and Salmon River,	Bellmont,	Franklin,	1,000
Fisheries, Game and Forest Com.,	Beaver River,	Webb,	Herkimer,	2,500
" "	North Branch Moose River,	"	"	1,000

DISTRIBUTION OF BROWN TROUT FINGERLINGS.—Continued.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Charles C. Stark,	Burton Brook,	Dover,	Dutchess,	1,000
Fisheries, Game and Forest Com.,	Spaulding Creek,	Bath,	Steuben,	500
" "	Cohocton River,	Cohocton,	"	1,500
William Crawford,	Valley Stream,	Blooming Grove,	Orange,	1,000
Fisheries, Game and Forest Com.,	Outlet Little Clear,	Santa Clara,	Franklin,	525
Edward I. Rice,	Green Lake,	Dewitt,	Onondaga,	1,000
W. W. Suits,	White Bottom Brook,	Memphis,	"	1,500
Fisheries, Game and Forest Com.,	Little Green Pond,	Santa Clara,	Franklin,	1,000
" "	New Hampshire Commission,	. . .	. . .	125
" "	Bartlett Pond,	Westport,	Essex,	3,000
W. E. Wolcott, Secretary,	Various streams,	Remsen, Trenton, etc.,	Oneida,	15,000
A. S. Rowley,	Griffin Creek and tributaries,	Cuba,	Allegany,	6,000
C. M. Williams,	Various streams,	Boliver, etc.,	Allegany and Cattaraugus,	4,000
W. D. Snell,	Big Brook, etc.,	Worth,	Jefferson,	2,000
C. A. Koenig,	Water,	Throop and Montezuma,	Cayuga,	1,000
Fisheries, Game and Forest Com.,	Fulton Chain of Lakes,	Webb,	Herkimer,	1,000
" "	Cold Spring Creek,	Urbana,	Steuben,	5,000
A. H. Fowler,	Judson Pond,	Danby,	Tompkins,	5,000
Cora Kansier,	Salmon Creek, Echo Lake,	Sodus Centre,	Wayne,	1,000
Niagara County Anglers' Club,	Red Creek and tributaries,	Newfane, Hartland, etc.,	Niagara,	1,000
W. W. Suits,	Dead Creek,	Van Buren,	Onondaga,	1,500
Rev. Pierce Cushing,	Allen's Creek,	Leroy,	Genesee,	2,500
Ira Elmendorf,	Esopus Creek,	Olive,	Ulster,	500
Fisheries, Game and Forest Com.,	Slade Brook, etc.,	Greenfield,	Saratoga,	500
" "	Wilkes and Spaulding Creeks,	Bath,	Steuben,	5,000
Marcien Skinner,	Bahsa's Kill,	Mamakating,	Sullivan,	1,000

DISTRIBUTION OF BROWN TROUT FINGERLINGS.—CONCLUDED.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
George B. Smith,	Sing Sing Creek, etc.,	Horseheads, etc.,	Chemung,	2,000
D. I. Roberts,	Ramapo Creek, etc.,	Tuxedo,	Orange,	1,000
Geneganslet Fish and Game Pro. Ass'n.,	Echo Lake, etc.,	Smithville,	Chenango,	500
H. E. Ganung,	Lake Wawaha,	Holcottsville,	Delaware,	2,000
John Bartholomew et al.,	Various streams,	Providence and Broadalbin,	Saratoga and Fulton,	4,000
D. J. Doughty, Secretary,	Inlet Canandaigua Lake,	Naples,	Ontario,	1,000

DISTRIBUTION OF BROWN TROUT YEARLINGS.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
William H. Shear,	Onesquethaw Creek,	Coyemans,	Albany,	1,000
C. T. Walter,	Local stream,	Dover,	Dutchess,	500
H. C. Allen,	Headwaters Otselic River,	Georgetown,	Madison,	800
D. B. Gray et al.,	Oatka Creek,	Wheatland,	Monroe,	300
Minot S. Mitchell,	Skinner Brook,	Norwich and N. Norwich,	Chenango,	100
R. Christian,	Adams Pond,	Elizabethtown,	Essex,	200
Fisheries, Game and Forest Com.,	Lake George,	Caldwell,	Warren,	1,000
Henry R. Bryan,	Lake Charlotte,	Gallatin,	Columbia,	50
William H. Manning,	Bog Meadow Brook,	Saratoga Springs,	Saratoga,	500
A. N. Cheney, President, etc.,	Half-Way Brook,	Queensbury and Kingsbury,	Warren and Washington,	2,000
P. H. Willey,	Glen Creek,	Dansville,	Livingston,	250

DISTRIBUTION OF BROWN TROUT YEARLINGS.—Concluded.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Honeoye Falls Anglers' Association,	Mendon Ponds,	Mendon,	Monroe,	200
P. A. Purdy, Secretary,	Various streams,	Smithville,	Chenango,	200
John J. Howe,	Hatch Pond,	Minerva,	Essex,	250
E. E. Ford,	Various streams,	Otsego,	Otsego,	800
Catskill Fish and Game Club,	Catskill Creek,	Catskill,	Greene,	350
George B. Smith,	Sing Sing Creek,	Big Flats,	Chemung,	400
John Hyland,	Mill Creek,	Wayland, Ossian and Dansville,	Livingston,	500
Fisheries, Game and Forest Com.,	Cohocton River,	Cohocton,	Steuben,	500
" "	Oatka Creek (2 to 5 lbs. each),	Wheatland,	Monroe,	242
" "	Onondaga Lake (adults),	. . . . . .	Onondaga,	9

DISTRIBUTION OF RAINBOW TROUT FRY.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
G. W. Lamont,	Big Indian Creek, etc.,	Big Indian,	Ulster,	20,000
Sherwood Phillips et al.,	Clove Creek,	Fishkill,	Dutchess,	20,000
John Hyland,	Headwaters Canaserago Creek,	South Dansville and Ossian,	Livingston and Steuben,	15,000
Fisheries, Game and Forest Com.,	Neils Creek,	Avoca and Freemont,	" "	10,000
" "	West Branch Inlet,	Jerusalem,	Yates,	15,000
" "	Keuka Lake and Outlet,	Urbana,	Steuben,	1,500
T. E. Harden,	Goodhue Lake,	Addison,	"	5,000

DISTRIBUTION OF RAINBOW TROUT YEARLINGS.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
James H. Hoadley,	Brantingham Lake,	Greig,	Lewis,	1,000
George Dart,	Johnstown Creek,	Tuxedo,	Orange,	1,000
Henry Loftie,	Onondaga Creek, etc.,	. . . . .	Onondaga,	500
J. W. Pond,	Ragged Lake,	Belmont,	Franklin,	500
Samuel R. Beardsley et al.,	Paradox Lake,	Severance,	Essex,	900
East Canada Lake Protective Ass'n,	East Canada Lakes,	Caroga,	Fulton,	1,000
George W. Cushman,	Lake Titus,	Malone,	Franklin,	1,000
Delevan Rod and Gun Club,	McKinstry Brooks, etc.,	Yorkshire,	Cattaraugus,	300
George V. Norton,	Stony Lake,	Watson,	Lewis,	500
Dr. H. M. Lincoln,	Various streams,	Wilton and Moreau,	Saratoga,	200
William H. Manning,	Kayaderosseras Creek,	Greenfield,	"	500
Frederick J. Jones,	Piseco Lake,	Arietta,	Hamilton,	300
S. D. Webb,	Flynn and Clear Creeks,	Arcade,	Wyoming,	300
L. W. Owen,	Big Tupper Lake,	Tupper Lake,	Franklin,	1,000
James A. Drake,	Lake Keuka,	Pultney,	Steuben,	1,000
Fisheries, Game and Forest Com.,	Spring Brook,	Taggart,	"	100
" "	Keuka Lake and Outlet,	Urbana,	"	2,500
" "	Big Moose Lake,	Webb,	Herkimer,	600
" "	Lower Saranac Lake,	Harrietstown,	Franklin,	1,400
" "	Hoel Pond,	Santa Clara,	"	250
" "	Lake George (fingerlings),	Caldwell,	Warren,	1,000
John P. Samson,	Oatka or Allen Creek,	Le Roy,	Genesee,	480
Fisheries, Game and Forest Com,	Keuka Lake (fingerlings),	Urbana,	Steuben,	15,000
J. O. Spellman,	Burke & Hill (18 months old),	Victor,	Ontario,	200
Fisheries, Game and Forest Com.,	Fulton Chain of Lakes,	Webb (18 months old),	Herkimer,	200
" "	North Branch, Moose River,	" "	"	540
" "	Echo Lake, etc. (fingerlings),	Smithville,	Chenango,	500

DISTRIBUTION OF RAINBOW TROUT YEARLINGS.—Concluded.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Fisheries, Game and Forest Com.,	Keuka Lake,		Steuben and Yates,	10,000
William H. Manning, President,	Various streams,	Greenfield,	Saratoga,	500
Fisheries, Game and Forest Com,	Upper Saranac Lake,	Harrietstown and Santa Clara,	Franklin,	1,250
" "	Onondaga Creek (adult),		Onondaga,	23
" "	Spring Creek (18 months old),	Wheatland,	Monroe,	257

DISTRIBUTION OF LAKE TROUT FRY.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Isaac N. Seligman,	Upper Saranac Lake,		Franklin,	75,000
" "	Raquette Lake, etc.,	Raquette Lake,	Hamilton,	50,000
F. W. Abrams,	Piseco Lake,	Arietta,	"	35,000
E. D. Crosley,	Skaneateles Lake,	Skaneateles, Safford and Scott,	Onondaga and Cortland,	100,000
Robert Lenox Banks,	Lake George,	Caldwell, Bolton, etc.,	Warren and Essex,	300,000
B. W. Carson,	Marsh Pond,	North Hudson,	Essex,	25,000
J. D. Mosley,	Sacandaga Lake,	Lake Pleasant,	Hamilton,	60,000
Will Osborne,	Lake Pleasant,	"	"	75,000
John McNeil,	Long Pond,	Waverly,	Franklin,	5,000
John C. Sturges,	Whitney Lake,	Arietta,	Hamilton,	20,000
Judson Newman Smith,	Big Trout Pond,	Atherton.	St. Lawrence,	10,000
J. B. Mills,	Schroon Lake,	Chester,	Warren,	50,000

DISTRIBUTION OF LAKE TROUT FRY.—CONTINUED.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Loon Lake Hotel Co.,	Loon Lake,	Franklin,	Franklin,	50,000
James McCormick,	Lewey Lake,	Lake Pleasant,	Hamilton,	10,000
Isaiah Perkins,	Mason Lake,	"	"	25,000
W. W. Aldrich, M.D.,	Siamese Ponds,	Johnsburgh,	Warren,	10,000
J. H. Lamphere,	Owasco Lake,	Owasco, Fleming, etc.,	Cayuga,	150,000
Howard M. Durant,	Big Forked Lake,	Long Lake,	Hamilton,	25,000
S. K. Fuller,	South Lake Reservoir,	Wilmurt,	Herkimer,	40,000
Orren Dunning,	Gilmour Lake,	Lake Pleasant,	Hamilton,	25,000
George Cecil,	Schroon Lake,	Horicon,	Warren,	25,000
Phillip Studor,	White Lake,	Forestport,	Oneida,	35,000
J. M. Wardner,	Rainbow Lake and Clear Pond,	Franklin and Brighton,	Franklin,	25,000
John H. Talham,	Fulton Chain of Lakes,	Webb,	Herkimer,	20,000
Milo E. Bull,	Fourth Lake,	"	"	40,000
H. H. Covey,	Big Moose,	"	"	20,000
D. J. Doughty, Secretary,	Head Canandaigua Lake,	South Bristol,	Ontario,	50,000
C. M. Barrett,	Third Lake,	Webb,	Herkimer,	20,000
William Dart,	Second Lake,	"	"	30,000
J. H. Higby,	Big Moose Lake,	"	"	20,000
George A. Stevens,	Lake Placid and Mirror Lake,	North Elba,	Essex,	75,000
David Douglas,	Silver Lake, etc.,	Black Brook,	Clinton,	35,000
Fisheries, Game and Forest Com.,	Seventh Lake,	Morehouse,	Hamilton,	10,000
" "	Eighth Lake,	"	"	10,000
" "	Hemlock Lake,		Livingston,	105,000
" "	Keuka Lake,		Yates and Steuben,	50,000
D. N. Riddle,	Various streams,	Santa Clara,	Franklin,	100,000
Fisheries, Game and Forest Com.,	Little Green Pond,	"	"	10,000
" "	Little Clear Pond,	"	"	25,000

DISTRIBUTION OF LAKE TROUT FRY.—Concluded.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Fisheries, Game and Forest Com.,	Big Clear Pond,	Harrietstown,	Franklin,	50,000
" "	Lower Saranac Lake,	"	"	100,000
" "	Upper St. Regis Lake,	Brighton,	"	25,000
" "	First Lake, Fulton Chain,	Webb,	Herkimer,	25,000
" "	Third Lake, Fulton Chain,	"	"	25,000
" "	Fourth Lake, Fulton Chain,	"	"	25,000
Canandaigua Rod and Gun Club,	Canandaigua Lake,	Canandaigua,	Ontario,	350,000

DISTRIBUTION OF LAKE TROUT FINGERLINGS.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
P. Studor,	White Lake,	Forestport,	Oneida,	1,000
S. A. Swenson,	Upper Saranac Lake,	Santa Clara,	Franklin,	2,500
Fisheries, Game and Forest Com.,	Big Clear Lake,	Harrietstown,	"	1,000
" "	Rainbow Lake,	Brighton and Franklin,	"	1,000
" "	Canandaigua Lake,	Canandaigua,	Ontario,	4,700
" "	Keuka Lake,	Hammondsport, etc.,	Steuben and Yates,	4,000
" "	Little Clear Pond,	Santa Clara,	Franklin,	550
E. D. Crosley,	Skaneateles Lake,	Skaneateles, etc.,	Onondaga, etc.,	20,000
Fisheries, Game and Forest Com.,	New Hampshire Commission,	. . . . . .	. . . . . .	320
" "	Chazy Lake,	Dannemora,	Clinton,	1,680
Canandaigua Rod and Gun Club,	Canandaigua Lake,	Canandaigua,	Ontario,	17,000
H. S. Stebbins,	Lake Keuka,	Hammondsport,	Steuben,	20,000

DISTRIBUTION OF LAKE TROUT FINGERLINGS.—CONCLUDED.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Fisheries, Game and Forest Com.,	Big Moose Lake,	Webb,	Herkimer,	25,000
" "	Lower Saranac Lake,	Harrietstown,	Franklin,	25,000
" "	Fourth Lake, Fulton Chain,	Webb,	Herkimer,	25,000
" "	Big Tupper Lake,	Altamont and Hopkinton,	Franklin and St. Lawrence,	10,000
" "	Upper Saranac Lake,	Santa Clara and Harrietstown,	Franklin,	40,000
" "	Loon Lake,	Franklin,	"	50,000
" "	Hemlock Lake,	Water,	Livingston,	15,000
" "	Keuka Lake,	Wayne,	Steuben,	10,000
A. H. Fowler,	Cayuga Lake,	Ithaca,	Tompkins,	10,000
David Scanlin,	Bonaparte Lake,	Diana,	Lewis,	2,500
C. T. Leland,	Schroon Lake,	Schroon,	Essex,	25,000
M. C. Paul,	Blue Mountain Lake,	Indian Lake,	Hamilton,	9,000
Geneganslet Fish and Game Club,	Echo Lake, etc.,	Smithville,	Chenango,	500
Fisheries, Game and Forest Com.,	Keuka Lake, etc.,	. . . . . .	Steuben and Yates,	5,000
David Roe, Jr.,	Seneca Lake,	Watkins,	Schuyler,	4,000
Fisheries, Game and Forest Com.,	Lake Placid,	North Elba,	Essex,	11,250
" "	Fulton Chain of Lakes,	Webb,	Herkimer,	13,000
" "	Seventh Lake,	Morehouse,	Hamilton,	2,500
" "	Big Clear,	Harriettstown,	Franklin,	3,200
" "	Little Clear,	Santa Clara,	"	1,950
" "	Upper Saranac Lake,	Santa Clara and Harrrietstown,	"	2,400

DISTRIBUTION OF LAKE TROUT YEARLINGS.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Robert S. Colman,	Lake George,	Caldwell and Bolton,	Warren,	2,000
Robert Lenox Banks,	"	" "	Warren and Essex,	2,000
Fisheries, Game and Forest Com.,	Hemlock Lake,	Livonia, Conesus, etc.,	Livingston,	333
" "	Big Moose Lake,	Webb,	Herkimer,	600

DISTRIBUTION OF CISCOES.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
C. W. McKinstry et al.,	Lake Ontario,	Lyme,	Jefferson,	11,000,000
Fisheries, Game and Forest Com.,	"	Charlotte,	Monroe,	3,500,000

DISTRIBUTION OF SHAD.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Fisheries, Game and Forest Com.,	Hudson River,	Albany,	Albany,	3,525,000
" "	"	Coxsackie,	Greene,	1,725,000
" "	"	Kingston, Newburgh, etc.	Ulster and Orange,	1,350,000
" "	"	Catskill,	Greene,	2,068,000
J. Henry Perkins,	Peconic River,	Riverhead,	Suffolk,	500,000
Fisheries, Game and Forest Com.,	Nissequogue River,	Smithtown,	"	950,000

DISTRIBUTION OF PIKE-PERCH FRY.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Samuel S. Inscho	Susquehanna River	Nichols	Tioga	300,000
E. L. Fisher, Secretary	Black Creek	Bergen	Genesee	500,000
C. Hicks	Upton's Lake	Clinton Corners	Dutchess	50,000
De Ruyter Sportsman's Club	De Ruyter Reservoir	De Ruyter	Madison	125,000
S. Makepeace	Clear Lake	Alexandria	Jefferson	200,000
H. C. Allen	Hatch's Lake	Eaton	Madison	150,000
E. A. Fay	Raquette River	Potsdam	St. Lawrence	100,000
Austin J. Tripp	Conesus Lake	Conesus, Livonia, etc.	Livingston	500,000
"	Genesee River	Avon	"	1,000,000
H. H. Widener	Black Creek	Chili and Riga	Monroe	200,000
Salamanca Rod and Gun Club	Allegany River	Salamanca	Cattaraugus	500,000
George B. Smith	Chemung River	Tioga	Chemung	500,000
Olean Sportsman's Club	Olean Creek, etc.	Olean	Cattaraugus	200,000
Frederick Mitchell	Chenango River	Smyrna, Sherburne, etc.	Chenango	100,000
C. A. Cline	Various ponds	North East	Dutchess	50,000
E. B. Wells	Madison Lake	Madison	Madison	50,000
James H. Glavin	Hudson River	Waterford	Saratoga	100,000
Frederick C. Bain	Snyder Pond	West Copake	Columbia	50,000
William E. Ames	Chenango and Tioughnioga Rivers	Chenango Forks	Broome	200,000
C. H. Wilcox	Lake Earlville	Lebanon	Madison	100,000
George Carver	Clyde River	Lyons and Galen	Wayne	50,000
Dr. Frederick Sauerbree	Lamson's Lake	New Scotland, etc.	Albany	50,000
Elisha N. Chapman	Schoharie River	Esperance	Schoharie	50,000
John A. Patterson	Various lakes	Woodbury	Orange	100,000
Jacob Gunther et al.	Wallkill River	"	"	645,000
J. E. Bierhardt, Secretary	Oneida River	Cicero and Clay	Onondaga	600,000
" "	Seneca River	Lysander and Van Buren	"	600,000

DISTRIBUTION OF PIKE-PERCH FRY.—Continued.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
R. M. Rush,	West Camden Lake,	Camden,	Oneida,	100,000
David Enders,	Schoharie River,	Esperance,	Schoharie,	50,000
William L. Coughtry,	Normanskill Creek,	New Scotland and Bethlehem,	Albany,	50,000
J. C. Gould,	York Lake,	Tusten,	Sullivan,	50,000
Thomas Watts,	Wallkill River,	. . . . . .	Orange,	35,000
D. I. Roberts,	Greenwood Lake,	Sterling Forest,	"	2,500,000
"	Otselic River,	Triangle,	Broome,	100,000
Honeoye Falls Anglers' Association,	Various waters,	Minden and Bloomfield,	Monroe and Ontario,	500,000
Richard W. Barford,	Kinderhook Lake,	Kinderhook,	Columbia,	50,000
G. F. Lee,	Various waters,	Pawling,	Dutchess,	50,000
H. P. Dain,	Crystal Lake, etc.,	Putnam Valley,	Putnam,	50,000
Moses F. Nelson,	Various waters,	Highlands,	Orange,	100,000
H. B. Whitney,	Canandaigua Outlet,	Phelps,	Ontario,	200,000
Whitmore Dusenbury,	Susquehanna River,	Windsor,	Broome,	100,000
James Bowes,	Maston Lake,	Mamakating,	Sullivan,	50,000
H. G. Cornell,	Niagara River,	Lewiston,	Niagara,	3,500,000
P. A. Purdy,	Various waters,	Smithville, etc.,	Chenango,	100,000
Daniel Kisselbrack,	Lower Rhoda Pond,	Ancram,	Columbia,	50,000
George T. Record,	Sharparoon Pond,	Dover,	Dutchess,	50,000
W. H. Brennan,	Chenango Lake,	New Berlin,	Chenango,	100,000
Clyde Gun Club,	Clyde River,	Galen,	Wayne,	100,000
T. H. Donnelly,	Silver Lake,	Castile and Perry,	Wyoming,	2,000,000
John H. Buss,	Cross Lake,	Eldridge,	Onondaga,	50,000
J. G. Norton,	Pochuck Creek,	Warwick,	Orange,	50,000
Gillman & McNeil,	Chenango River,	Oxford,	Chenango,	100,000

DISTRIBUTION OF PIKE-PERCH FRY.—Concluded.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
R. P. Grant,	St. Lawrence River,		Jefferson,	4,000,000
Leatherstocking Club,	Oswego River,		Oswego,	3,000,000
Claude Carroll,	Smith's and Louck's Ponds,	Howard and Avoca,	Steuben,	100,000
Henry Loftie,	Oneida Lake,		Oswego and Onondaga,	15,000,000
Saratoga Co. Fish and Game Ass'n,	Saratoga Lake,	Saratoga, Stillwater and Malta,	Saratoga,	150,000
J. F. Bennett,	Shawangunk Creek,	Mamakating,	Sullivan,	50,000
Charles T. Silsby,	Cayuga Lake,		Cayuga and Seneca,	600,000
Joseph Winsor,	Unadilla River,	Otsego, etc.,	Otsego and Chenango,	50,000
James A. Fulton,	Bashaw Kill,	Mamakating,	Sullivan,	50,000
D. I. Roberts,	Summit and Twin Lakes,	Wood,	Orange,	50,000
"	Watson Lake,	Chester,	"	50,000
"	Hackensack River,	Orangetown,	Rockland,	50,000
Sheridan Shook,	Shook's Lake,	Red Hook,	Dutchess,	50,000
Jacob C. Weaver,	Thompson's Lake,	Guilderland,	Albany,	50,000
D. I. Roberts,	Delaware River, etc.,	Cochecton,	Sullivan,	50,000
"	Cromwell and Summit Lakes,	Highland Mills,	Orange,	50,000
Charles F. Hall,	Meade's Pond,	North Norwich,	Chenango,	50,000
John Craiggs Co.,	Red Creek,	Walworth,	Wayne,	100,000
O. A. Tompkins,	Connewango River,	Randolph,	Cattaraugus,	200,000
Alexander P. Milne,	Mud Creek,	Palmyra,	Wayne,	100,000
Charles A. Weiting,	Tributaries Cobleskill Creek,	Cobleskill,	Schoharie,	50,000
Fisheries, Game and Forest Com.,	Honeoye Creek,	Rush,	Monroe,	600,000
" "	Genesee River,	Rochester,	"	3,000,000
" "	Three-Mile Bay,	Lyme,	Jefferson,	4,800,000

DISTRIBUTION OF LARGE MOUTH BLACK BASS.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
E. L. Fisher, Secretary,	Black Creek,	Bergen,	Genesee,	1,000
T. C. Porter,	Long Pond,	Neversink,	Sullivan,	1,000
Abram J. Miller,	Tonetta Lake, etc.,	South East,	Putnam,	2,000
Dr. H. M. Lincoln,	Snootkill Creek,	Wilton and Northumberland,	Saratoga,	1,000
John F. Smith,	Lamson's Lake,	New Scotland and Coeymans,	Albany,	1,000
H. L. Reed,	Mohawk River, etc.,	Amsterdam,	Montgomery,	1,000
T. P. Bowler,	Mohawk River,	"	"	1,000
H. C. Hanson et al.,	Wallkill River,	. . . . . .	Orange,	6,000
B. J. Palmer,	Mud Creek,	Arcadia,	Wayne,	1,000
William L. Coughtry,	Normanskill Creek,	New Scotland and Bethlehem,	Albany,	1,000
D. I. Roberts,	Greenwood Lake,	Sterling Forest,	Orange,	5,000
Joseph Rake,	Various waters,	Monroe,	"	1,000
W. D. Snell,	Stony Creek,	Adams,	Jefferson,	1,000
Clyde Gun Club,	Clyde River,	Galen,	Wayne,	1,000
Arthur Fox,	West Creek and ponds,	Seward,	Schoharie,	1,000
Charles Washburne,	Mohawk River,	Mohawk,	Montgomery,	1,000
Saratoga Co. Fish and Game Ass'n,	Saratoga Lake,	Saratoga, Stillwater and Malta,	Saratoga,	1,000
D. I. Roberts,	Ramapo streams, etc.,	Monroe,	Orange,	1,000
Isaac H. Reamer,	Thompson's Lake,	Knox and Berne,	Albany,	1,000
S. D. Smith,	Lake Mount Basha,	Monroe,	Orange,	1,000
Batavia Fish and Game Club,	Tonawanda River,	Batavia,	Genesee,	1,000
Fisheries, Game and Forest Com.,	Genesee River,	Rochester,	Monroe,	8,000

DISTRIBUTION OF MASCALONGE.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
S. B. Ruttenber,	Mud Lake,	Villenova and Arkwright,	Chautauqua,	50,000
J. D. Gallup,	Hurlbut's Pond,	Clymer,	"	50,000
R. P. Grant,	St. Lawrence River,		Jefferson,	850,000
Honest Fishermen's Club,	Cayuga Lake,	Seneca Falls,	Seneca,	250,000
Fisheries, Game and Forest Com.,	Chautauqua Lake,		Chautauqua,	1,815,000
Pennsylvania Fish Com.,	Eggs,			60,000

DISTRIBUTION OF TOM CODS.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Benjamin S. Weeks,	Lemon Creek,	Westfield,	Richmond,	2,000,000
Fisheries, Game and Forest Com.,	Oyster Bay Harbor,	Oyster Bay,	Queens,	1,600,000
" "	New Rochelle Harbor,		Westchester,	2,000,000
" "	Huntington Bay,	Huntington,	Suffolk,	3,000,000
" "	Northport Harbor,	Smithtown,	"	2,000,000
" "	Smithtown River,	"	"	2,000,000
" "	Great South Bay,	"	"	2,000,000
" "	Cold Spring Harbor,		"	28,075,000

DISTRIBUTION OF ADIRONDACK FROST-FISH.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
J. D. Mosley,	Sacandaga Lake,	Lake Pleasant,	Hamilton,	300,000
Will Osborne,	Lake Pleasant,	"	"	500,000
George A. McCoy,	Little Tupper Lake,	Long Lake,	"	200,000
J. B. Mills,	Schroon Lake,	Chester,	Warren,	200,000
H. H. Covey,	Big Moose Lake,	Webb,	Herkimer,	500,000
J. M. Wardner,	Rainbow Lake and Clear Pond,	Franklin and Brighton,	Franklin,	200,000
Fisheries, Game and Forest Com.,	Seventh Lake, Fulton Chain,	Morehouse,	Hamilton,	500,000
" "	Fourth Lake, Fulton Chain,	Morehouse and Webb,	Hamilton and Herkimer,	2,000,000
" "	Second Lake, Fulton Chain,	Webb,	Herkimer,	400,000
" "	Third Lake, Fulton Chain,	"	"	1,000,000
" "	First Lake, Fulton Chain,	"	"	400,000
" "	Mud Lake,	Lake Pleasant,	Hamilton,	200,000
" "	Piseco Lake,	Arietta,	"	300,000
" "	Lake Placid,	St. Armand,	Essex,	500,000
" "	Loon Lake,	Franklin,	Franklin,	200,000
" "	Hoel Pond,	Santa Clara,	"	400,000
" "	Upper Saranac Lake,	"	"	400,000
" "	Little Clear Pond,	"	"	500,000
" "	Little Green Pond,	"	"	200,000
" "	Lower Saranac Lake,	Harrietstown,	"	400,000
" "	Big Clear Pond,	"	"	1,000,000
L. W. Owen,	Big Tupper Lake,	Altamont,	"	300,000

DISTRIBUTION OF WHITEFISH.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
E. N. Wilson,	Lake Ontario,	Carlton,	Orleans,	2,000,000
B. F. Petheram,	Skaneateles Lake,	Skaneateles, Niles and Spofford,	Onondaga and Cayuga,	2,000,000
Canandaigua Rod and Gun Club,	Canandaigua Lake,	Canandaigua,	Ontario,	5,000,000
H. H. Shaw,	Lake Ontario,	Lyme,	Jefferson,	3,160,000
H. S. Stebbins,	Lake Keuka,	Urbana,	Steuben,	1,000,000
H. G. Cornell,	Niagara River,	Lewiston,	Niagara,	4,000,000
Fisheries, Game and Forest Com.,	Lake Erie,	Dunkirk,	Chautauqua,	1,250,000
" "	Lake Ontario,	Charlotte,	Monroe,	3,250,000

DISTRIBUTION OF SMELTS.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Benjamin S. Weeks,	Lemon Creek,	Westfield,	Richmond,	2,000,000
Fisheries, Game and Forest Com.,	Cold Spring Harbor,	Huntington and Oyster Bay,	Suffolk,	34,000,000
" "	Smithtown River,	Smithtown,	"	1,000,000
" "	Huntington Harbor,	Huntington,	"	4,000,000
" "	Northport Harbor,	"	"	4,000,000

DISTRIBUTION OF SHRIMPS.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
J. O. Ballard,	Cold Brook,	Bellmont,	Franklin,	5,000
Herman S. Mase,	Clare Creek,	Fishkill,	Dutchess,	3,000
Avery L. Foote,	East Palmyra Spring Brook,	Palmyra,	Wayne,	5,000
W. C. Witherbee,	Various waters,	. . . . . .	Essex,	4,000
C. R. Kennedy,	Various brooks,	Huron and Rose,	Wayne,	3,000

DISTRIBUTION OF LOBSTERS.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Benjamin S. Weeks,	Raritan Bay,	Westfield,	Richmond,	100,000
Fisheries, Game and Forest Com.,	Long Island Sound,	Oyster Bay (Center Island Reef),	Queens,	1,390,640
" "	Cold Spring Harbor,	Oyster Bay (Rocky Point),	"	46,000
" "	Long Island Sound,	Huntington (Sound Reef),	Suffolk,	1,000,000
" "	" "	Huntington (Easton's Neck Reef),	"	1,750,440
" "	" "	Huntington (Lloyd's Neck Reef,)	"	2,609,340

DISTRIBUTION OF BULLHEADS.

NAME OF APPLICANT	WATER STOCKED	TOWN	COUNTY	AMOUNT
Anthony Drum,	Rhoda Lake,	West Copake,	Columbia,	700
J. C. Gould,	York Lake,	Tusten,	Sullivan,	1,000
Mordecai Evans,	Plymouth Pond,	Plymouth,	Chenango,	1,000

DISTRIBUTION OF LAND-LOCKED SALMON.

NAME OF APPLICANT	SIZE	WATER STOCKED	TOWN	COUNTY	AMOUNT
Fisheries, Game and Forest Com.,	Fingerlings,	Little Clear Lake,	Santa Clara,	Franklin,	620
" "	"	Little Green Lake,	"	"	500
C. H. Babcock,	"	Irondequoit Creek,	Brighton,	Monroe,	100
Fisheries, Game and Forest Com.,	Yearlings,	Hemlock Lake,	Livonia and Conesus	Livingston,	834

DISTRIBUTION OF STEEL-HEAD TROUT.

NAME OF APPLICANT	SIZE	WATER STOCKED	COUNTY	AMOUNT
Fisheries, Game and Forest Com.,	2 months old,	Little Clear Pond,	Franklin,	3,750
" "	Fingerlings,	Upper Saranac Lake,	"	8,250
" "	"	Little Green and Little Clear Lakes,	"	2,000
" "	"	Keuka Lake,	Yates,	500
" "	2 years old,	Onondaga Lake,	Onondaga,	3

DISTRIBUTION OF SWISS LAKE TROUT.

NAME OF APPLICANT	SIZE	WATER STOCKED	COUNTY	AMOUNT
Fisheries, Game and Forest Com.,	Fingerlings,	Lake George,	Warren,	1,000
" "	Yearlings,	Hemlock Lake,	Livingston,	2,200
" "	"	Keuka Lake,	Steuben,	1,000

DISTRIBUTION OF FISHES NOT SCHEDULED ELSEWHERE.

NAME OF APPLICANT	VARIETY	SIZE	WATER STOCKED	COUNTY	AMOUNT
Fisheries, Game and Forest Com.,	Scotch Sea Trout,	Yearlings,	Hemlock Lake,	Livingston,	708
" "	Red Throat Trout,	2 years old,	Onondaga Creek,	Onondaga,	3
" "	Atlantic Salmon,	Fry,	Tributaries of Hudson River	Saratoga,	80,000
" "	White Perch,	Adult,	Genessee River,	Monroe,	120

RECAPITULATION.

Distribution of Fish for Year Ending September 30, 1897.

Species.	Age.	Amount Planted.	
Brook trout,	Fry,	3,729,000	
Brook trout,	Fingerlings,	118,500	
Brook trout,	Yearlings and older,	31,902	
	Total,		3,879,402
Brown trout,	Fry,	893,000	
Brown trout,	Fingerlings,	88,150	
Brown trout,	Yearlings,	10,400	
Brown trout,	Adult,	251	
	Total,		991,801
Rainbow trout,	Fry,	100,000	
Rainbow trout,	Fingerlings and yearlings,	43,580	
Rainbow trout,	Adult and 18 months old,	1,220	
	Total,		144,800
Lake trout,	Fry,	2,445,000	
Lake trout,	Fingerlings,	364,050	
Lake trout,	Yearlings,	4,933	
	Total,		2,813,983
Land-locked salmon,	Fingerlings,	1,220	
Land-locked salmon,	Yearlings,	834	
	Total,		2,054
Steel-head trout,	Two months,	3,750	
Steel-head trout,	Fingerlings, etc.,	10,753	
	Total,		14,503
Swiss lake trout,	Fingerlings,	1,000	
Swiss lake trout,	Yearlings,	3,200	
	Total,		4,200
Scotch sea trout,	Yearlings,	708	
Shrimps,		20,000	
Red-throat trout,	Two years,	3	
Atlantic salmon,	Fry,	80,000	
Whitefish,	Fry,	21,660,000	
Smelt,	Fry,	45,000,000	
Ciscoes,	Fry,	14,500,000	
Frost-fish,	Fry,	10,600,000	
Tom cods,	Fry,	44,675,000	
	Forward,	136,535,711	7,850,743

SPECIES.	AGE.		AMOUNT PLANTED.	
		Brought forward,	136,535,711	7,850,743
Shad,	Fry,	. . . .	10,118,000	
Pike-perch,	Fry,	. . . .	49,405,000	
Mascalonge,	Fry,	. . . .	3,075,000	
Lobsters,		. . . .	6,896,420	
Black bass (large mouth),	Fry,	. . . .	39,000	
Bullheads,	Fry,	. . . .	2,700	
White perch,	Adult,	. . . .	120	
				206,071,951
		Grand total, ...		213,922,694

COMMON WHITEFISH FEMALE FROM HEMLOCK LAKE.

(COREGONUS CLUPEIFORMIS, Mitchill.)

A Synopsis of the History of Fish Culture.

A COMPLETE history of pisciculture in all its details is, I believe, yet to be written. Much concerning it can be gathered by searching here and there, but no one has seen fit to gather all these fragments together in a continuous story of what has come to be an important factor in furnishing food for the people of a good portion of the world. An encyclopædia will say that pisciculture was practiced by the ancient Egyptians and that it was in use by the Chinese, and that is all. How it was practiced in Egypt or what use was made of it in China in the dim past is of little moment now, for in all probability the people of those countries at that time knew nothing of fish culture as practiced to-day. The people of this century are given to demanding facts based upon figures, when history is offered to them; and, leaving speculation out of the question, I will recite briefly some of the beginnings of pisciculture. It has been claimed that a French monk, Dom Pinchon, in the Abbey of Reome discovered the process of hatching fish eggs in 1420, but it is believed by those best informed that he simply collected and transplanted eggs that had been naturally impregnated.

GENESIS OF ANGLING.

The real father of fish culture, who first fecundated fish eggs artificially, was Stephen Ludwig Jacobi, a German, born April 28, 1709, at Hohenhausen, in the Province of Varenholz. In 1741 he took eggs and milt from trout by hand and fertilized them artificially, and that was the genesis of modern pisciculture. For hatching trout ova, Jacobi used wooden troughs, the bottom covered with gravel, to represent the natural spawning

beds of the fish, a process abandoned by most fish breeders, but in vogue to-day at one of the largest hatching stations of the United States Fish Commission. Jacobi did not make his discovery known until 1763 when his methods were published in a Hanoverian Magazine. The next year his discovery was endorsed by German naturalists; his memoir was published in Paris in 1770; he was recognized by George III. of England, in 1771, who granted him a life pension for his discovery; his memoir was translated into English in London in 1788, and there can be no doubt regarding the title that has been given him as the first to discover and carry into practical usefulness the art of fish culture.

John Shaw was the first to artificially fecundate the eggs of salmon in Great Britain, in the year 1837, and Dr. Theodatus Garlick was the father of fish culture in America. Garlick read of the experiments of Gehin and Remy in France, in 1842, which were simply modeled after Jacobi's methods, and in 1853 he impregnated the eggs of trout and hatched them in January, 1854. Public fish culture in the United States did not follow until 1856, when the General Court of Massachusetts appointed three Commissioners "to ascertain such facts respecting the artificial propagation of fish as may tend to show the practicability and expediency of introducing the same into the Commonwealth under the protection of law." The same year, Mr. V. P. Vrasski, a Russian fish culturist, discovered the method of dry impregnation, a method which nearly doubled the impregnation of eggs taken artificially. Before this time the eggs and milt of trout had been taken in a vessel of water with the idea of adhering as nearly as possible to natural processes.

Down to 1854, all fish-cultural experiments had been conducted with eggs of the Salmon family, chiefly trout, *Salmo fario* in Europe, and *Salvelinus fontinalis* in America. Vrasski attempted to propagate the eel artificially, as well as the trout, in the year 1854. In 1857, the eggs of the whitefish from Lake Ontario, *Coregonus clupeiformis,* were impregnated, and an attempt was made the same year to propagate the pike-perch, *Stizostedion vitreum.* Both experiments were made by Carl Müller, of New York, and Henry Brown, of New Haven, Conn. All the salmon family experimented with up to this date were fall spawning fishes, which fishes spawn on a falling temperature, but the pike-perch is a spring spawner and spawns on a rising temperature. Consequently the pike-perch was the first of the spring spawning fishes attempted to be hatched by artificial means, but it could not have been very successful as will be shown later in this article.

The first attempt to introduce salmon into Australia was made in 1862, by Mr. H. R. Francis, of England. The eggs sent from England to Tasmania were a failure; not so those sent in 1864 and afterward. The first attempt to breed salmon in America was made in 1864. The eggs were obtained in Europe and hatched in a

CALEDONIA HATCHERY. INTERIOR.

studio in New York City by Mr. James B. Johnson. In 1865, the first successful attempt to hatch codfish eggs was made in Norway, and two years later the Seth Green shad hatching box was invented; and thus the list of fishes with different breeding seasons and with eggs of a different character hatched artificially continued to grow. The trout (except some species in Western United States that are spring spawners) and salmon are fall spawning fishes, with heavy non-adhesive eggs; the codfish a winter spawning sea fish with floating eggs, and the shad a spring spawning fish with semi-bouyant, non-adhesive eggs. As the eggs of these fishes required each a different treatment to hatch them successfully, great progress was made in the science of fish culture in a few years.

Chapter 285 of the Laws of New York for 1868, is entitled: "An act to appoint Commissioners of Fisheries, for the State of New York." This was passed April 22, and the first Fish Commission in this State was created. Under this act ex-Governor Horatio Seymour, Seth Green and Robert B. Roosevelt were appointed Commissioners and the first report made by this Commission was issued in March, 1869.

In the light of what has been accomplished in this State to increase the supply of food fishes by the Fish Commissioners and their successors the Fisheries, Game and Forest Commissioners since the date of the first report, it is of interest to read that few shad were taken in the Hudson River when the Fish Commission first examined the river, and that the retail price of the few rarely fell below seventy-five cents each.

On one portion of the river "the fishermen did not average four fish a day and on another portion the seines were not taking over one shad to a haul."

The Commissioners estimated the shad crop in the Hudson River to be worth $7,000 in 1869.

In 1895 the shad taken in the Hudson River weighed over 4,000,000 pounds and at ten cents each for buck shad and twenty cents for roe shad the catch was worth $184,897.60—nearly four times as much as the entire annual expenses of the Fisheries, Game and Forest Commission for fish propagation and distribution.

In 1870, the Deutscher Fischerei Verein was established, an organization which has had a powerful influence in piscicultural matters in Europe. Different States in the United States and other countries in Europe than those mentioned had not been idle during the years already mentioned. Italy, Bohemia, Austria, Switzerland, Finland, Belgium, Holland, Russia and Canada had been making progress in fish culture and had established fish breeding establishments, and the States of Massachusetts, Vermont, New Hampshire, Connecticut, Pennsylvania, Maine, California, New Jersey, Rhode Island and Alabama had organized Fish Commissions and constructed fish hatching stations that were hatching fish and planting them in the public waters of the respective States. In 1870, an organization was formed (the

original call was sent out in 1869) that was destined to give a great impetus to fish breeding in the United States. This was the American Fish Cultural Association, now called the American Fisheries Society. This organization was practically founded by Livinston Stone, author of the standard work, "Domesticated Trout," and a pioneer fish culturist, as he erected a trout hatchery in 1866, near Charlestown, New Hampshire. Mr. Stone signed the call for the first meeting of a few fish breeders, and was the first secretary and drew up the constitution practically as it remains to this day, and at the outset he was in effect the Association. The Fish Cultural Association was the godfather of the United States Fish Commission, for one of its first official acts was to send a committee to Washington to urge the creation of a National Fish Commission, which was provided for by joint resolution of Congress on February 9, 1871, and the Commission organized the following year. The same year shad were hatched, transported across the Continent from the Atlantic to the Pacific and established in the waters of the western coast. Shad from this planting have become so numerous on the Pacific Coast that they have been sold at a less price than on the Atlantic sea board, and they have spread along the coast until it is expected that they will ultimately reach the Sea of Japan. In 1872, Mr. Stone went to California to inaugurate the propagation of Pacific salmon, a work which has grown to gigantic proportions. At one station during the season of 1896, 25,852,880 eggs of the Pacific salmon were taken. Striped bass, *Roccus lineatus*, were artificially propagated in 1873, and sea bass, *Centropristes striatus*, in 1874. White fish were sent to New Zealand from the United States in 1876, the experiment being successful, so far as the arrival of the eggs in good condition is concerned. In 1877, experiments were successfully conducted for retarding the development of fish eggs by cold; herring were propagated artificially; German carp were introduced into the United States; California salmon were introduced into Europe, and the plunging bucket for hatching shad was invented. For the next few years reports of the capture of planted fish were received from many waters; haddock, *Melanogrammus æglefinus*, and Spanish mackerel, *Scomberomorus maculatus*, were successfully propagated, and the establishment of fish commissions in the various States of the Union continued until nearly every State was at work increasing its food supply by cultivating fishes.

The operation of hatching fish ova differs with different species of fish (after the eggs are impregnated) depending upon the character of the eggs. The fertilization of the eggs is always the same with all species. The fishes cultivated artificially in Europe are the so-called game fishes or hook and line fishes chiefly. In America not only are the hook and line fishes propagated but a large number of commercial fishes also. The Atlantic salmon, *Salmo salar*; Pacific or quinnat salmon, *Oncorhynchus tschawytscha;* land-locked salmon, *Salmo salar Sebago;* red salmon, *O. nerka;*

CALEDONIA HATCHERY LOOKING DOWN STREAM.

REARING BOXES FOR FINGERLINGS IN FRONT OF BUILDINGS AT LEFT.

silver salmon, *O. kisutch;* brook trout, *Salvelinus fontinalis;* rainbow trout, *Salmo irideus;* steelhead trout, *Salmo gairdneri;* black spotted or Rocky Mountain trout, *Salmo mykiss;* Sunapee trout, *Salvelinus alpinus aureolus;* lake trout, *Cristivomer namaycush;* Loch Leven trout, *Salmo levenensis;* brown trout, *Salmo fario;* yellow finned trout, *Salmo mykiss macdonaldi;* whitefish, *Coregonus clupeiformis;* striped bass, *Roccus lineatus;* shad, *Alosa sapidissima;* pike-perch, *Stizostedion vitreum;* sea bass, *Centropristes striatus;* Adirondack frostfish or round whitefish, *Coregonus quadrilateralis;* codfish, *Gadus callarias;* alewives, *Pomolobus æstivalis;* flatfish, *Pseudopleuronectes americanus;* crappies, *Pomoxis sparoides*, and *P. annularis;* flounder, *Paralichthys oblongus;* haddock, *Melanogrammus æglefinus;* lake herring, *Argyrosomus artedi;* lake sturgeon, *Ancipenser rubicundis;* mackerel, *Scomber scombrus;* mascalonge, *Lucius masquinongy;* sea herring, *Clupea harengus;* squeteague, *Cynoscion regalis;* tautog or blackfish, *Tautoga onitus;* tomcod, *Microgadus tomcod;* smelt, *Osmerus mordax*, are some of the fishes, and it is not a complete list, that are propagated in America. It will be observed that several of the so-called trout in the foregoing list are charrs, *salvelinus*, but the word charr is never used in America, as it is in England. All the members of the salmon family are commonly called either salmon or trout, except the golden trout, found in Sunapee Lake, in the State of New Hampshire; and transplanted by this Commission to the waters of this State; this fish is frequently called the American or Sunapee saibling.

The first step in hatching fish eggs is to obtain ripe fish of both sexes, that is, fish that are ready to deposit their ova naturally. Where stock fish are maintained, as at a hatching station, all the fish are under observation and control and it is a simple matter to pick out the fish ready to cast their ova, and wait for others to become ripe. In wild waters where fish are netted to obtain their spawn, some species are placed in breeding pens until they mature, but most commercial fishes are simply netted and the ripe fish selected and all others returned to the water, and are perhaps netted again and again before the season is over.

Does it hurt the trout to take the spawn artificially? No; if the operator is a skillful man in handling breeding fish, and none but skillful men are employed in the business at the National and State hatcheries. Stock fish are handled year after year at the spawning stations without injury, as a rule until, in fact, they cease to breed, or make way for younger fish in the stock ponds.

When, for instance, trout are ready to spawn at a hatching station, the male and female fish are taken from the stock ponds with dip net and placed in tubs, the sexes being separated. A pan, earthen or tin, generally the latter, is filled with water and at once the water is poured from it, leaving only such moisture as may adhere to the sides and bottom of the pan. A female fish is taken in hand by the operator, one

hand covered with a wet woolen mitten grasps the fish above the tail and with the thumb of the other hand the operator presses the abdomen gently, with a downward motion over the ovaries, holding the vent over the spawning pan; if the fish is ripe, the eggs will run freely. Very little force should be used in the operation and the fish should be held close to the pan. Practice teaches the operator to distinguish a ripe fish as soon as it is in his hands. The male fish is treated in exactly the same manner, and the milt flows into the spawning pan with the eggs, and milt and eggs are stirred together with a feather, with the tail of the fish if it is small, with the operator's hand, or by gently tilting the pan from side to side. This is called the dry method of impregnation because the eggs and milt are taken in a dry spawning pan, instead of one partly filled with water; and by the dry process one hundred per cent. of good salmon or trout eggs may be impregnated, while by the wet process (an inch or two of water in the spawning pan) only from sixty to seventy per cent. are impregnated. The eggs are quickly impregnated, within a quarter of an hour after they come in contact with the milt, no matter what the temperature of the water may be, and it is usually accomplished in two or three minutes. A little water is then added to the pan and the eggs are left until they separate. Eggs when they come from the fish are not round, but slightly shrivelled; when fertilization takes place, the eggs absorb not only zoospermes, minute organism of which the milt is composed, but water as well, and during the process of absorption the eggs adhere to the pan and to one another. When absorption is completed the eggs are round and plump and they separate and are ready after a thorough washing to be placed on the hatching trays or glass grills. In America trays are used, sides and ends of wood and bottom of wire that is tarred. These trays are placed in wooden troughs containing running water and are left to hatch. Trout eggs are heavy and non-adhesive and about one-sixth of an inch in diameter. The average production of eggs is from 350 to 1,500, depending upon the age and size of the fish. With water at fifty degrees Fahrenheit the eggs hatch in about fifty days. But with water at about thirty-four degrees Fahrenheit they will require over 150 days, 157 days being the record in one of the New York State hatcheries. Impregnated eggs are amber-colored, and dead eggs are white as chalk, and must be picked out from the good eggs to prevent the spread of disease to the good eggs. Shad eggs are semi-bouyant, non-adhesive, and smaller than

POSITION OF HANDS IN STRIPPING A SMALL TROUT.

CALEDONIA HATCHERY, SHOWING STOCK PONDS.

than trout eggs, being about one-eighth of an inch in diameter. Shad average 30,000 eggs, but a single fish has been known to produce as high as 156,000. Shad being a spring spawning fish the eggs hatch in from three to nine days, and the treatment is different from that of trout and other heavy, non-adhesive eggs. Shad eggs are placed in a hatching jar of glass which admits water from the bottom and the pressure or flow is regulated to hold the eggs in suspension as it were. Trout fry are born with a large umbilical sac on which the fish feeds by absorption for from twenty to forty days and which to all intents and purpose anchors the trout fry to the bottom until the sac is nearly absorbed. Shad are born with a very small umbilical sac and swim away with it as soon as the fish is hatched. Codfish eggs, one-eighteenth of an inch in diameter, are bouyant, non-adhesive, and are hatched in a "tidal hatcher" supposed to represent, in the action of water in the troughs, the action of the tides. A codfish produces as many as 9,000,000 eggs at one time. The eggs float during nearly the whole time of incubation, fourteen to twenty-one days, with the water from thirty-eight to forty-three degrees Fahrenheit. Pike-perch eggs are heavy and adhesive and one-thirteenth of an inch in diameter. The eggs are hatched in a McDonald or Chase hatching jar, the same that is used in shad work; but after impregnation they are treated to a bath of water and powdered loam, the water so thick with the loam that it is muddy. The eggs in bunches being covered with mucous they are soon coated with the fine particles of loam in the water, but to separate the eggs so that each particular egg may become coated, they are placed in a metal cylinder with an intake at the bottom; the water is cut off at the intake and air is blown through the water which separates the bunches of eggs, and the loam in the water coats them and prevents them from adhering again; after they are thoroughly blown they are placed in the hatching jar where they hatch in from twelve to sixteen days, and the fry absorb the sac in from six to twelve days after they are born, with the water about forty-five degrees Fahrenheit. Mascalonge have eggs that are semi-bouyant and slightly adhesive. They produce as many as 300,000 eggs or more, and the average is about 100,000, the eggs being one-eleventh of an inch in diameter. The ova are hatched in doublewire covered boxes sunk in the lake where the parent fish are found, as well as in hatching jars. The wire is doubled at top and bottom of the boxes, with space between, to protect the eggs from predatory fishes and other enemies, and they hatch in about fifteen days with water at fifty-five degrees Fahrenheit and it requires the same length of time for the sac to absorb.

In the annual reports of the National and State Fish Commissions in America, there are given figures to show how many fish have been hatched and planted during the year. How can little fish be counted by the hundreds of millions? The fish are not counted but the eggs from which the fish are hatched are measured into the

hatching trays, jars or boxes, the loss in dead eggs during the process of hatching is deducted, and the result is over rather than under the number which the reports show to have been planted. The measure used is the standard fluid quart of 57.75 cubic inches. Eggs of the same species of fish may differ in size in fishes of different ages. Brook trout (*fontinalis*) vary from 13,998 to 12,063 to the quart. The figures are from actual counts made; the first was made in Washington at the central station of the United States Fish Commission, the last was made in the State of Connecticut. Brown trout (*fario*) vary from 8,311 to 9,935 to the quart. Perhaps the greatest variation is in rainbow trout eggs (*irideus*). In California but 6,875 were counted in a quart, while in Michigan, where the fish were introduced, 12,800 were counted from a quart. The following are the average number of eggs in a quart from the fishes named: Atlantic salmon, 4,272; land-locked salmon, the largest eggs of any fresh-water fish that is propagated, 3,300; Pacific salmon, 3,696; Spanish mackerel, 1,267,728; codfish, 335,000; striped bass, 24,363; shad, 28,239; pike-perch, 152,294; mascalonge, 73,938; whitefish, 36,800; lake trout, 5,525; tomcod, 233,280; smelt, 496,000; Adirondack frostfish (round whitefish), 33,000.

The Fisheries, Game and Forest Commission hatched and planted in the public waters of the State during the year 1897, 213,922,694 fish of various kinds and ages. Of this number nearly 8,000,000 were trout; 50,000,000 pike-perch; 10,000,000 shad; 7,000,000 lobsters; 21,000,000 whitefish; 44,000,000 tomcod; 3,000,000 mascalonge; 80,000 sea salmon.

A. N. CHENEY,
State Fish Culturist.

"NOT ALL OF FISHING TO FISH."

GREAT BLUE HERON

(ARDEA HERODIAS. Linnaeus.)

Winged Enemies of Fish.

THE FIGHT IS ON.

SOME idea of the serious loss of fish and fish eggs caused by myriads of enemies in and about the waters is conveyed in a paragraph of Dr. Day's book upon the British and Irish Salmonidæ. He says: "So enormous is the loss which occurs among the eggs and young, that in such a river as the Severn the annual produce of salmon and grilse at the present time (1887) consist of about twenty thousand fish. Were all the ova of one female salmon of about twenty pounds weight to be hatched and attain maturity, they would suffice for keeping up the stock to its present condition." The Severn is 200 miles long and receives five principal tributaries.

Chief among the destroyers of fish are certain birds and winged insects. The common crow, the crow blackbird, hawks, bluejay, some owls, grebes, gulls and terns, have the reputation of poaching to some extent, but their depredations are much less in our State than the ravages of such birds for example as the herons, kingfisher, certain ducks, loons and fish-hawk. Chief among these is the

Night Heron. In the report of the Pennsylvania Fish Commission for 1897, Dr. B. H. Warren publishes some interesting notes on the destructive work of the black crown *night heron.* In a small pool at Westchester, Pennsylvania, twenty-five goldfish were placed. Two night herons caught all but one of them before the following morning. A night heron killed near a branch of White Clay Creek, in Pennsylvania, had the tail of a common sucker of about twelve inches long, projecting four inches beyond its bill. The head and shoulders, except the bony portion, were eaten away by the gastric juice of the stomach. Dr. Warren examined the stomachs of about twenty of these herons which were shot in June near their breeding ground, and found fish remains in all of them.

In July, 1883, Dr. Rudolph Hessel shot a night heron containing the heads of seventy-eight young carp. This bird is sometimes called *blue heron,* and is also quite

generally called a *crane*, but this is erroneous. It is found in large numbers, and in the breeding season forms rookeries which are a serious menace to the fishing waters of the neighborhood. It is extremely shy and cautious, fishing chiefly at night or early in the morning. It stands perfectly motionless in the water until a fish comes within reach when it strikes with its long, sharp, heavy bill, which deals death to any of the fish kind.

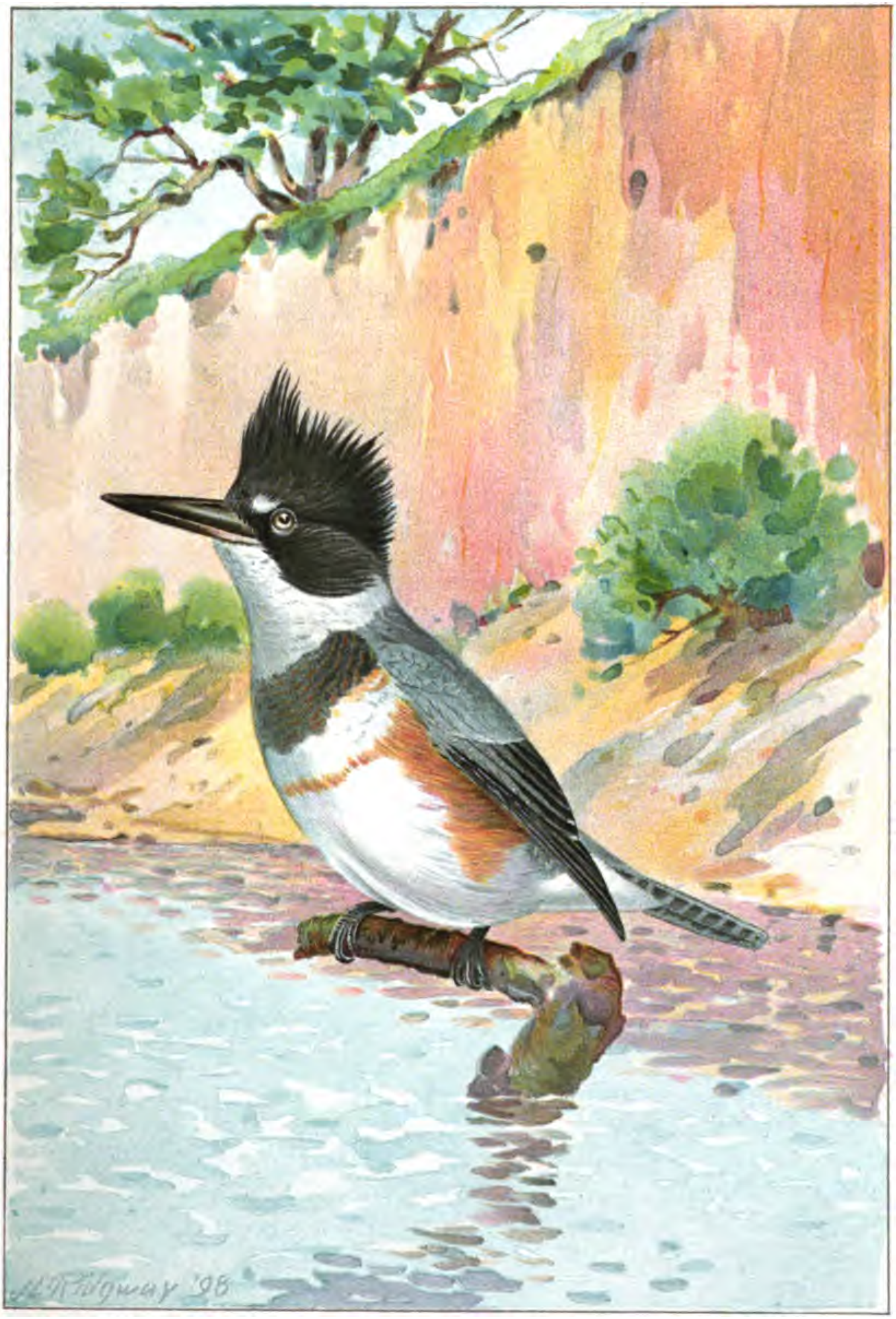
They have been caught in steel traps set in ponds within twenty feet of a hatchery building. The traps are set in shallow water, taking precaution to secure them so as to prevent the bird flying away with them. When a heron is captured in a trap he should be killed at once with a long club or a load of shot. Great care should be taken to keep out of the reach of his murderous bill. Once I had the misfortune to be struck by a wounded heron, and I am sure that if his bill had struck me squarely on the hand it would have gone entirely through. As it was, the blow was a glancing one, striking me on the knuckle, but it stripped off the flesh to the very bone. I have sometimes heard a great flopping and disturbance in the waters of our Caledonia trout brook at night, and upon going to the place in the morning found heron tracks in the mud, and sometimes a trout from one-half pound to two pounds in weight, and occasionally larger, with a hole in its back or side, into which you could put your finger. I always supposed the fish escaped on account of its being too strong and lively for the heron, although mortally wounded. I have seen as many as a dozen six-inch trout in the throat and stomach of a heron killed in the early morning hours.

In Germany, and elsewhere in Europe, herons work great injury to the fish culturists. In the government fisheries the regulations prescribe that they must be killed and their roosts destroyed, but in spite of these measures their numbers are seriously large in many places, and owners of ponds trap them with steel traps baited with fish.

The small *green heron* and the *bittern* are also in the list of fish destroyers, but they are less destructive than the night heron on account of their smaller size, but their presence about fish preserves is not at all beneficial and they should be killed.

Kingfisher. The kingfisher is one of the most active, impudent and persistent of the enemies of fish wherever found, and it is only too abundant for the good of angling. According to Dr. Brehm, the common European kingfisher on the average destroys daily ten or twelve fish, each about as long as a man's finger. In fourteen years a German fish culturist caught upwards of 700 kingfishers near his trout ponds. The bird is equally abundant and quite as destructive in New York, and may be regarded as one of the pests afflicting the fish culturist.

I have known of upwards of 180 kingfishers being destroyed on one-half mile of Caledonia Spring Creek in one season; they were shot and trapped.



KINGFISHER.

(CERYLE ALCYON, Boie.)

In 1884 I rented an old mill pond in Genesee County, N. Y., posted it with a view of making a trout preserve as the pond was fed by cold spring brooks, and contained nothing but trout. I visited the pond on an average once in two weeks with a few friends for a day's sport. Noticing that the kingfishers were quite numerous, I suggested to the farmer's son residing near-by, and who also watched the ponds for me, that if he would trap and shoot the kingfishers I would give him ten cents each. This was followed up until I found it most too expensive, as the young man produced the heads or bodies of from ten to thirty kingfishers every time I visited the place.

The clattering notes of this bird are heard from early in the spring until cold weather, and even before the spring season is open as if impatient for it to come. He is never satisfied, being on the lookout from daylight until dark and is ever ready for a plunge into the water at sight of his prey. He can take as many fish as the average sportsman.

In the article of Dr. Warren above referred to are some accounts of the destruction wrought by the belted kingfishers. Mr. C. K. Sober, of Lewisburg, Pa., found thirteen small brook trout in one of these birds which was shot on Baker Run. An acquaintance of Dr. Warren some years ago had a large number of gold fish in a pond. Two pairs of kingfishers built their nests in a sand-bank near the pond. In one summer these birds destroyed nearly all the small-sized fish in the place. Out of thirty-eight of these birds taken about streams and mill ponds, thirty-six contained nothing but fish remains.

Kingfishers can be successfully captured in traps fastened at the top of stakes driven in the bank about trout ponds or along trout streams. The stake or pole should be from ten to fifteen feet long. If the top of the stake is not sufficiently large to support the steel trap, nail a small block of wood on the end of the pole. The trap is set but not baited. When the trap is set the little plate that springs the trap when disturbed, is the highest point of the trap. The trap must be securely fastened to the stake by a cord, small wire or chain. The birds on visiting the ponds or stream will invariably fly to one of these stakes, light on the highest point and be captured. I have found a small round steel trap (one without the shank or tail-piece) to be best for this work. One of these traps captured twenty-five kingfishers in one summer at a trout preserve in Cattaraugus County. Of course the pole and trap should be set up near a fishing ground where the bird may think it is a splendid spot for observation.

Ducks. Domestic ducks as well as geese are great destroyers of fish, and should never be allowed on trout waters. I have seen a tame duck capture and devour a trout seven inches long. They also feed on the natural food of the fish. Wild ducks of some species are equally troublesome and especially the mergansers, saw bills, shelldrakes or fish-ducks.

The merganser is very destructive at all times, but particularly in winter when most of the streams and lakes are frozen over. They often congregate on small streams or ponds that do not freeze on account of their uniform temperature. These waters are invariably trout waters. During severe winters, this fish-duck sometimes remains on Caledonia Creek for a month at a time. At such times it is very shy, and it is almost impossible to get a shot at them, or keep them away from the stream. Trout spawning beds are also tempting spots for the fish-duck to congregate and feed. I have sometimes found red flannel flags placed on poles stuck in the bank along the stream useful for scaring the ducks away.

Loons. Dr. Warren examined the stomachs of sixteen loons, three of which were the red-throated species, and found remains of fish in thirteen. Fall fish, suckers, carp, catfish, and also a brook trout seven inches long were found in the stomachs of loons killed in Pennsylvania.

On the inland lakes of New York these birds subsist chiefly upon fish and destroy a great many. In the counties of Chester, Delaware, Clinton and Lehigh, Pa., the stomach contents of seven loons captured during the winter months consisted entirely of fish-bones and scales.

Loons are sometimes caught alive in pound nets set by the fishermen of the Great Lakes, or on the sea coast. They are very dangerous to handle on account of the strength and sharpness of their bill, and their savage disposition.

Grebes. The grebe, known also as hell divers and waterwitches, feed upon fish, frogs, aquatic insects, especially beetles and water plants. They nest in streams, lakes, and ponds, usually building among reeds or rushes, and lay from six to eight eggs of uniform color. They are distributed all over the world, and are everywhere known as expert divers and swimmers, and generally destructive to fish.

The horned or crested grebe lives principally upon small fish. These birds are so exceedingly cautious and swift in their movements, that it is quite difficult to shoot them, but by persistent watching it can be accomplished, as many duck shooters know. One of the best ways to reduce their number is by taking their eggs from the rudely constructed nests in the reeds and thickets close to the surface of the water. The eggs of the horned grebe are greenish.

Fish-hawk. The depredations of the fish-hawk are more frequent along the sea coast than on inland waters, but the birds are often found along our large rivers and over large lakes and ponds. They are usually solitary in spring and fall, but sometimes hunt in pairs and will remain about mill dams and fish ponds a few days at a time if not driven away.

I have known of their taking trout of one-half pound weight from my private trout pounds.

CALEDONIA HATCHERY, FROM BELOW, LOOKING UP-STREAM.

Dr. Warren examined the stomachs of twenty-three and found nothing in them but fish remains. Fish-hawks are quite common throughout the Adirondack region. Goldfish ponds are particularly liable to attack from fish-hawks owing to the bright color of their occupants.

Bald Eagle. The national bird usually plays the rôle of a fish thief, his victim being the fish-hawk, but occasionally has been seen fishing in shallow parts of small creeks on his own account.

Audubon states that he saw a bald eagle capture a number of red fins in Perkiomen Creek, Pa., by wading briskly through the water and striking at them with his bill. On the Island of Kadiak, Alaska, according to Dr. Bean, this eagle is actively engaged in fishing, and is most abundant around the salmon lakes and shallow bays.

Many of the observing guides of the Adirondacks will tell you how they have seen a bald eagle attack a fish-hawk in the air, and make him drop the fish he had just captured from the lake below, and before the fish could strike the water the eagle would swoop down and catch it in his claws, but the eagle is so very scarce in New York that it hardly seems right to recommend their destruction even if the law would permit it, which it does not.

Barred Owl. Although this bird is commonly credited with the destruction of fish food, such as snails, caddis larvæ and crayfish, it has sometimes been accused of catching fish. An instance of the capture of a large brook trout at the State Hatchery, at Allentown, Pa., by a *barred owl* was reported several years ago, and Dr. Warren was informed by residents of Florida, in 1885, that the bird frequently caught fish in that State, securing them by dexterous movement of the foot while sitting close to the water's edge.

The common hoot owl, or screech owl, quite often causes trouble. I have caught them in traps set for muskrats four inches under water. They were after the fish food of the stream, such as caddis larvæ, crayfish, shrimp, etc. I have seen two or three quarts of the caddis larvæ cases in a pile that had been collected from the water by a screech owl, the larvæ being pulled from the case and devoured by the owl.

Injurious Insects. The damage to fish eggs and young fish caused by insects and the larvæ which pass a portion of their existence in water, is less noticeable than the injury done by birds, but it is much greater than one would suppose without investigation.

The larvæ of the dragon flies, and the great water beetles and water bugs are well known enemies of fish.

Several kinds of water beetles, particularly the rapacious dytiscus, devour fry in enormous numbers, and the great water bug called belostoma by entomologists is also injurious in trout waters. Both the beetles and their larvæ completely devour eggs

and little fish measuring several inches in length, while they often eat holes into larger fish. This large water beetle often leaves the water, perhaps for a little exercise. Whether they fly during daylight I cannot say, but I have seen and secured them near an electric light located within a short distance of a stream.

We do not see and therefore do not know the full extent of the depredations continually going on around us, but when we stop to realize the fruits of our labor and patient expectation, we are astonished by the scarcity of fish and often inclined to place the blame where it does not belong. Nature's checks upon over-production are sometimes more effective than man's most ingenious devices for the legitimate capture or legal destruction of fish, but at the present state of the fishing waters in New York it is safe to say that we could get along without nature's checks.

J. ANNIN, Jr.,
Superintendent of Hatcheries.

A PIKE AT ITS BEST.

The Fisheries of Lake Ontario in 1897.*

By JOHN N. COBB, Field Agent, U. S. Fish Commission.

THE WAY.

THE following pages present the results of an investigation of the fisheries of Lake Ontario for the year 1897, the work having been taken up in December, after the fishing season had ended. No attention was paid to the wholesale trade, which is unimportant, nor to the import trade in Canadian fish which is carried on at Cape Vincent, Oswego and North Fair Haven.

The principal fishing grounds of the lake are in Chaumont, Black River and Henderson Bays, in Jefferson county, and Mexico Bay, in Oswego county, in which waters all kinds of netting are allowed. The only other regions of importance are off Sodus Point, in Wayne county, and off the shores of Orleans and Niagara counties. In this latter region no netting is allowed within one mile of the shore and as a result only gill nets and set lines are used.

The most important fishing places are Cape Vincent, Three Mile Bay, and Chaumont, in Jefferson county; Sandy Creek and Oswego, in Oswego county; North Fair Haven, in Cayuga county; Sodus Point, in Wayne county; Oak Orchard (Point Breeze P. O.), in Orleans county; and Wilson, Olcott and Youngstown, in Niagara county. At Cape Vincent, Oswego and North Fair Haven are dealers who import Canadian fish. Except at Cape Vincent, this business is unimportant. During the latter half of 1897 very little fishing was done from Oswego.

In Niagara county during the years 1890 and 1893, 160,349 and 69,109 pounds, respectively, of longjaws were secured by the fishermen. In 1897, only 350 pounds

* I am under obligation to Hon. George M. Bowers, U. S. Commissioner of Fish and Fisheries, for permission to utilize the figures gathered by myself in preparing this article.

were taken. In the same county, in 1890, 730 pounds of whitefish were taken; in 1893, 45,380 pounds were taken; while in 1897 the catch amounted to 138,549 pounds. Whether there is any connection between the almost total extinction of one species coincident with such a great increase of another species from almost nothing, is a matter the fishermen are unable to explain.

The following three tables show the main features of the fisheries of the lake for the year 1897.

The first table shows the number of men engaged in the fisheries in different capacities, also the number and value of vessels and boats, the quantity and value of apparatus, and the shore property in the different counties. The vessel fisheries of this lake have always been insignificant. In 1897, five men were engaged in the vessel fisheries and five in the transporting trade. The shore and boat fisheries were prosecuted by 238 men. Jefferson county had the largest number of men engaged in the fisheries, 103, followed by Niagara county with 51.

The vessel engaged in the fisheries in Wayne county only made one short trip, when the business was abandoned. The total investment in the industry was $35,998, of which sum Jefferson county is to be credited with $13,845, over one-third of the total investment. The most important form of apparatus was the gill net, of which 289,420 feet, valued at $7,354, were employed. The next most important form of apparatus was trap nets, of which 111, valued at $3,850, were in use.

The quantity and value of each important species taken in 1897 are shown in the second table. The aggregate catch was 920,996 pounds, valued at $34,295. The principal species taken were the whitefish, sturgeon, perch and bullheads. Jefferson county caught more than all the other counties combined. Niagara county occupies second place.

The third table shows the quantity and value of the species taken in each principal form of apparatus. Gill nets occupy first place with 451,011 pounds, valued at $20,899, which represents nearly one-half of the total catch, and over one-half the total value. The principal species taken were whitefish, perch and sturgeon. All but 11,625 pounds of the total catch of whitefish were secured in gill nets. Trap nets come next with 218,899 pounds, valued at $4,952. The principal species taken in trap nets were eels, perch and bullheads. Fyke nets, seines, hand lines, set lines and spears follow in the order named.

TABLE SHOWING BY COUNTIES THE MEN, VESSELS, BOATS, APPARATUS, AND SHORE PROPERTY EMPLOYED IN THE FISHERIES OF LAKE ONTARIO IN 1897.

DESIGNATION	JEFFERSON		OSWEGO		CAYUGA		WAYNE	
	NUMBER	VALUE	NUMBER	VALUE	NUMBER	VALUE	NUMBER	VALUE
Vessels fishing							1	$3,750
Tonnage							42.41	
Outfit								70
Men							5	
Vessels transporting			1	$2,000				
Tonnage			13.69					
Outfit				240				
Men			5					
Boats	77	$4,551	13	655	9	$560	22	650
Fishermen	103		31		9		25	
Apparatus of capture:								
Gill nets ... feet	66,104	1,932	38,877	908	30	2	53,640	1,165
Trap nets	111	3,850						
Fyke nets	115	1,150					14	70
Seines	8	205	5	1,280				
Hand lines	40	60			33	30	20	8
Set lines ... feet			90,400	444			39,600	105
Spears	4	4						
Shore property		2,093		2,585				435
Total		$13,845		$8,112		$592		$6,253

TABLE SHOWING BY COUNTIES THE MEN, VESSELS, BOATS, APPARATUS, AND SHORE PROPERTY EMPLOYED IN THE FISHERIES OF LAKE ONTARIO IN 1897.—CONTINUED.

DESIGNATION	MONROE		ORLEANS		NIAGARA		TOTAL	
	NUMBER	VALUE	NUMBER	VALUE	NUMBER	VALUE	NUMBER	VALUE
Vessels fishing							1	$3,750
Tonnage							42.41	
Outfit								70
Men							5	
Vessels transporting							1	2,000
Tonnage							13.69	
Outfit								240
Men							5	
Boats	4	$300	7	$380	30	$1,475	162	8,571
Fishermen	6		13		51		238	
Apparatus of capture:								
Gill nets ... feet	31,432	670	15,055	597	84,282	2,080	289,420	7,354
Trap nets							111	3,850
Fyke nets	15	75					144	1,295
Seines							13	1,485
Hand lines							93	98
Set lines ... feet	10,560	20	23,760	70	33,000	67	197,320	706
Spears							4	4
Shore property		300		185		977		6,575
Total		$1,365		$1,232		$4,599		$35,998

TABLE SHOWING BY COUNTIES AND SPECIES THE YIELD OF THE FISHERIES OF LAKE ONTARIO IN 1897.

SPECIES	JEFFERSON		OSWEGO		CAYUGA		WAYNE	
	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE
Black bass	22,104	$1,191			2,600	$260	5,000	$350
Blue pike	13,675	620	125	$5			6,946	278
Bloater, or longjaw	1,048	33	12,000	420	1,300	104	4,050	210
Bullheads	103,654	2,307	16,000	400	1,600	80	1,840	74
Catfish	1,750	53						
Eels	65,419	1,677	500	20				
Herring, fresh	10,324	369	2,500	75			5,990	240
Herring, salted	2,860	261						
Ling								
Mullet	7,947	81	5,405	108				
Perch	82,812	946			10,150	507	35,845	1,434
Pickerel	39,964	1,349			5,990	299	17,144	686
Rock bass	6,376	65						
Sand pike								
Sturgeon	42,593	2,165	14,706	883			10,653	799
Suckers	26,558	269	10,500	204			520	5
Sunfish	17,723	178						
Trout	2,475	101						
White bass								
Whitefish	10,617	471	13,500	540			5,477	449
Yellow, or wall-eyed pike	4,594	254					22	1
Total	462,493	$12,390	75,236	$2,655	21,640	$1,250	93,487	$4,526

TABLE SHOWING BY COUNTIES AND SPECIES THE YIELD OF THE FISHERIES OF LAKE ONTARIO IN 1897.—CONTINUED.

SPECIES	MONROE		ORLEANS		NIAGARA		TOTAL	
	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE
Black bass	....	....	....	....	....	....	29,704	$1,801
Blue pike	....	....	880	$44	27,368	$1,031	48,994	1,978
Bloater, or longjaw	2,600	$104	....	....	350	11	21,348	882
Bullheads	....	....	....	....	100	4	123,194	2,865
Catfish	....	....	....	....	....	....	1,750	53
Eels	....	....	....	....	....	....	65,919	1,697
Herring, fresh	3,350	144	....	....	50	2	22,214	830
Herring, salted	....	....	....	....	....	....	2,860	261
Ling	....	....	....	....	1,892	46	1,892	46
Mullet	....	....	....	....	....	....	13,352	189
Perch	8,000	293	2,255	113	30,192	1,484	169,254	4,777
Pickerel	1,160	47	....	....	....	....	64,258	2,381
Rock bass	....	....	....	....	....	....	6,376	65
Sand pike	....	....	....	....	233	12	233	12
Sturgeon	3,700	278	9,853	740	20,130	1,517	101,635	6,382
Suckers	1,040	10	....	....	1,500	51	40,118	539
Sunfish	....	....	....	....	....	....	17,723	178
Trout	....	....	....	....	374	29	2,849	130
White bass	....	....	....	....	739	38	739	38
Whitefish	2,000	160	11,825	706	138,549	6,610	181,968	8,936
Yellow or wall-eyed pike	....	....	....	....	....	....	4,616	255
Total	21,850	$1,036	24,813	$1,603	221,477	$10,835	920,996	$34,295

TABLE SHOWING, BY COUNTIES, APPARATUS, AND SPECIES, THE YIELD OF THE FISHERIES OF LAKE ONTARIO IN 1897.

APPARATUS AND SPECIES	JEFFERSON		OSWEGO		CAYUGA		WAYNE	
	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE
Gill nets:								
Blue pike	10,085	$481	75	$3	....	....	6,946	$278
Bullheads	1,910	42	....	....	1,600	$80	1,840	74
Bloater, or longjaw	1,048	33	12,000	420	1,300	104	4,050	210
Herring, fresh	9,324	339	2,500	75	....	....	5,990	240
Herring, salted	2,860	261	....	....	....	....	....	....
Mullet	558	7	....	....	....	....	....	....
Perch	12,858	157	....	....	2,220	110	29,845	1,194
Pickerel	8,009	239	....	....	....	....	10,604	424
Rock bass	671	7	....	....	....	....	....	....
Sturgeon	32,906	1,767	6,906	414	....	....	7,853	589
Suckers	4,883	49	600	6	....	....	....	....
Trout	2,475	101	....	....	....	....	....	....
Whitefish	4,992	221	7,500	300	....	....	5,477	449
Yellow pike	356	15	....	....	....	....	22	1
Total	92,935	$3,719	29,581	$1,218	5,100	$294	72,627	$3,459

TABLE SHOWING, BY COUNTIES, APPARATUS, AND SPECIES, THE YIELD OF THE FISHERIES OF LAKE ONTARIO IN 1897.—CONTINUED.

APPARATUS AND SPECIES	MONROE		ORLEANS		NIAGARA		TOTAL	
	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE
Gill nets:								
Blue pike	....	....	800	$44	27,368	$1,031	45,354	$1,837
Bullheads	....	....	....	....	100	4	5,450	200
Bloater, or longjaw	2,600	$104	....	....	350	11	21,348	882
Herring, fresh	3,350	144	....	....	50	2	21,214	800
Herring, salted	....	....	....	....	....	....	2,860	261
Ling	....	....	....	....	1,892	46	1,892	46
Mullet	....	....	....	....	....	....	558	7
Perch	8,000	293	2,255	113	30,192	1,484	85,350	3,351
Pickerel	50	3	....	....	....	....	18,663	666
Rock bass	....	....	....	....	....	....	671	7
Sand pike	....	....	....	....	233	12	233	12
Sturgeon	167	13	3,204	240	14,050	1,061	65,086	4,084
Suckers	1,040	10	....	....	1,500	51	8,023	116
Trout	....	....	....	....	374	29	2,849	130
White bass	....	....	....	....	739	38	739	38
Whitefish	2,000	160	11,825	706	138,549	6,610	170,343	8,446
Yellow pike	....	....	....	....	....	....	378	16
Total	17,207	$727	18,164	$1,103	215,397	$10,379	451,011	$20,899

TABLE SHOWING, BY COUNTIES, APPARATUS, AND SPECIES, THE YIELD OF THE FISHERIES OF LAKE ONTARIO IN 1897.—CONTINUED.

APPARATUS AND SPECIES	JEFFERSON		OSWEGO		CAYUGA		WAYNE	
	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE
Trap nets:								
Black bass	6,890	$346	.....	.....	.....	.....	.....	.....
Blue pike	3,590	139	.....	.....	.....	.....	.....	.....
Bullheads	41,894	1,043	.....	.....	.....	.....	.....	.....
Catfish	1,150	35	.....	.....	.....	.....	.....	.....
Eels	47,204	1,201	.....	.....	.....	.....	.....	.....
Herring	1,000	30	.....	.....	.....	.....	.....	.....
Mullet	5,924	60	.....	.....	.....	.....	.....	.....
Perch	46,311	468	.....	.....	.....	.....	.....	.....
Pickerel	15,722	475	.....	.....	.....	.....	.....	.....
Rock bass	5,025	51	.....	.....	.....	.....	.....	.....
Sturgeon	9,487	384	.....	.....	.....	.....	.....	.....
Suckers	12,820	131	.....	.....	.....	.....	.....	.....
Sunfish	12,499	125	.....	.....	.....	.....	.....	.....
Whitefish	5,625	250	.....	.....	.....	.....	.....	.....
Yellow pike	3,758	214	.....	.....	.....	.....	.....	.....
Total	218,899	$4,952	.....	.....	.....	.....	.....	.....

TABLE SHOWING, BY COUNTIES, APPARATUS, AND SPECIES, THE YIELD OF THE FISHERIES OF LAKE ONTARIO IN 1897.—CONTINUED.

APPARATUS AND SPECIES	MONROE		ORLEANS		NIAGARA		TOTAL	
	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE
Trap nets:								
Black bass	....	....	....	....	....	....	6,890	$346
Blue pike	....	....	....	....	....	....	3,590	139
Bullheads	....	....	....	....	....	....	41,894	1,043
Catfish	....	....	....	....	....	....	1,150	35
Eels	....	....	....	....	....	....	47,204	1,201
Herring	....	....	....	....	....	....	1,000	30
Mullet	....	....	....	....	....	....	5,924	60
Perch	....	....	....	....	....	....	46,311	468
Pickerel	....	....	....	....	....	....	15,722	475
Rock bass	....	....	....	....	....	....	5,025	51
Sturgeon	....	....	....	....	....	....	9,487	384
Suckers	....	....	....	....	....	....	12,820	131
Sunfish	....	....	....	....	....	....	12,499	125
Whitefish	....	....	....	....	....	....	5,625	250
Yellow pike	....	....	....	....	....	....	3,758	214
Total	....	....	....	....	....	....	218,899	$4,952

TABLE SHOWING, BY COUNTIES, APPARATUS, AND SPECIES, THE YIELD OF THE FISHERIES OF LAKE ONTARIO IN 1897.—CONTINUED.

APPARATUS AND SPECIES	JEFFERSON		OSWEGO		CAYUGA		WAYNE	
	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE
Fyke nets:								
Black bass	1,000	$50	....	....	....	....	....	....
Bullheads	50,700	998	....	....	....	....	19,400	$679
Eels	15,215	390	....	....	....	....	....	....
Mullet	625	6	....	....	....	....	....	....
Perch	13,100	146	....	....	....	....	....	....
Pickerel	6,260	205	....	....	....	....	2,540	102
Suckers	3,665	37	....	....	....	....	520	5
Sunfish	1,924	20	....	....	....	....	5,800	116
Yellow pike	250	13	....	....	....	....	....	....
Total	92,739	$1,865	....	....	....	....	28,260	$902

TABLE SHOWING, BY COUNTIES, APPARATUS, AND SPECIES, THE YIELD OF THE FISHERIES OF LAKE ONTARIO IN 1897.—CONTINUED.

APPARATUS AND SPECIES	MONROE		ORLEANS		NIAGARA		TOTAL	
	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE
Fyke nets:								
Black bass	....	....	....	....	....	....	1,000	$50
Bullheads	7,280	$255	....	....	....	....	77,380	1,932
Eels	....	....	....	....	....	....	15,215	390
Mullet	....	....	....	....	....	....	625	6
Perch	....	....	....	....	....	....	13,100	146
Pickerel	1,110	44	....	....	....	....	9,910	351
Suckers	....	....	....	....	....	....	4,185	42
Sunfish	1,400	14	....	....	....	....	9,124	150
Yellow pike	....	....	....	....	....	....	250	13
Total	9,790	$313	....	....	....	....	130,789	$3,080

TABLE SHOWING, BY COUNTIES, APPARATUS, AND SPECIES, THE YIELD OF THE FISHERIES OF LAKE ONTARIO IN 1897.—CONTINUED.

APPARATUS AND SPECIES	JEFFERSON		OSWEGO		CAYUGA		WAYNE	
	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE
Seines:								
Black bass	75	$4						
Blue pike			50	$2				
Bullheads	9,150	224	16,000	400				
Catfish	600	18						
Eels	2,350	69	500	20				
Mullet	840	8	5,405	108				
Perch	8,425	154						
Pickerel	9,878	427						
Rock bass	680	7						
Sturgeon	200	14						
Suckers	5,190	52	9,900	198				
Sunfish	3,300	33						
Whitefish			6,000	240				
Yellow pike	230	12						
Total	40,918	$1,022	37,855	$968				

TABLE SHOWING, BY COUNTIES, APPARATUS, AND SPECIES, THE YIELD OF THE FISHERIES OF LAKE ONTARIO IN 1897.—CONTINUED.

APPARATUS AND SPECIES	MONROE		ORLEANS		NIAGARA		TOTAL	
	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE
Seines:								
Black bass	....	....	....	....	....	....	75	$4
Blue pike	....	....	....	....	....	....	50	2
Bullheads	....	....	....	....	....	....	25,150	624
Catfish	....	....	....	....	....	....	600	18
Eels	....	....	....	....	....	....	2,850	89
Mullet	....	....	....	....	....	....	6,245	116
Perch	....	....	....	....	....	....	8,425	154
Pickerel	....	....	....	....	....	....	9,878	427
Rock bass	....	....	....	....	....	....	680	7
Sturgeon	....	....	....	....	....	....	200	14
Suckers	....	....	....	....	....	....	15,090	250
Sunfish	....	....	....	....	....	....	3,300	33
Whitefish	....	....	....	....	....	....	6,000	240
Yellow pike	....	....	....	....	....	....	230	12
Total	....	....	....	....	....	....	78,773	$1,990

TABLE SHOWING, BY COUNTIES, APPARATUS, AND SPECIES, THE YIELD OF THE FISHERIES OF LAKE ONTARIO IN 1897.—CONTINUED.

APPARATUS AND SPECIES	JEFFERSON		OSWEGO		CAYUGA		WAYNE	
	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE
Hand lines:								
Black bass	14,139	$791	....	....	2,600	$260	5,000	$350
Perch	2,118	21	....	....	7,950	397	6,000	240
Pickerel	95	3	....	....	5,990	299	4,000	160
Total	16,352	$815	....	....	16,540	$956	15,000	$750
Set lines:								
Sturgeon	....	....	7,800	$469	....	....	2,800	$210
Spears:								
Eels	650	$17	....	....	....	....	....	....
Grand total	462,493	$12,390	75,236	$2,655	21,640	$1,250	118,687	$5,321

TABLE SHOWING, BY COUNTIES, APPARATUS, AND SPECIES, THE YIELD OF THE FISHERIES OF LAKE ONTARIO IN 1897.—CONCLUDED.

APPARATUS AND SPECIES	MONROE		ORLEANS		NIAGARA		TOTAL	
	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE
Hand lines:								
Black bass	....	....	....	....	....	....	21,739	$1,401
Perch	....	....	....	....	....	....	16,068	658
Pickerel	....	....	....	....	....	....	10,085	462
Total	....	....	....	....	....	....	47,892	$2,521
Set lines:								
Sturgeon	3,533	$265	6,649	$500	6,080	$456	26,862	$1,900
Spears:								
Eels	....	....	....	....	....	....	650	17
Grand total	30,530	$1,305	24,813	$1,603	221,477	$10,835	954,876	$35,359

A review of the past and present condition of the fisheries of Lake Ontario does not furnish many encouraging signs. The United States Commission of Fish and Fisheries has made five statistical canvasses of the fisheries of the Great Lakes since its creation and these furnish abundant material for comparison purposes. The following table shows the catch of certain species in Lake Ontario for the years 1880, 1885, 1890, 1893 and 1897:

COMPARATIVE TABLE SHOWING (IN POUNDS) THE YIELD OF THE FISHERIES OF LAKE ONTARIO IN 1880, 1885, 1890, 1893 AND 1897.

SPECIES	1880	1885	1890	1893	1897
Herring, (including longjaws)	611,219	403,585	598,978	164,998	46,222
Sturgeon	545,283	386,974	541,752	56,863	101,635
Trout	569,700	20,510	41,010	6,204	2,349
Whitefish	1,064,000	90,711	148,771	45,380	181,968
Other Fish	849,800	1,496,686	2,115,937	586,140	586,722
Total	3,640,000	2,398,466	3,446,448	859,585	920,896
Total value	$159,700	$95,869	$124,786	$29,260	$34,295

There has been a great decrease in the more valuable varieties, and, up to 1890, a great increase in the cheaper grades. This latter increase, however, has not been maintained since 1890, the catch dropping off very materially.

Part of this great decrease in the fisheries can be explained by the stringent laws governing the commercial fishermen, but the main cause is the scarcity of fish. This latter view is borne out by the almost practically unanimous testimony of the fishermen themselves.

A gratifying increase is shown in the catch of whitefish in 1897 over that for 1890 and 1893. The fishermen ascribe this increase to the numerous plants of fry which have been made in the lake.

Fishways, their Construction and Use.

THE BOWMAN.

THE first printed report made by any Fish Commission in the United States was made to the Governor and Council of the Commonwealth of Massachusetts, and was dated December 1, 1865, and signed by Theodore Lyman and Alfred A. Reed as Commissioners. The report was made under a "resolve of May 3, 1865, concerning the obstructions to the passage of fish in the Merrimack and Connecticut rivers." The Commissioners were directed to report upon certain specified subjects:

"No. 5. To ascertain the extent and degree of the discoloration of the water of said rivers, below said dams, caused by the discharge of dyestuffs and other noxious matter therein from manufactories.

"No. 6. And the effect of such matter upon the water and the fish inhabiting the same.

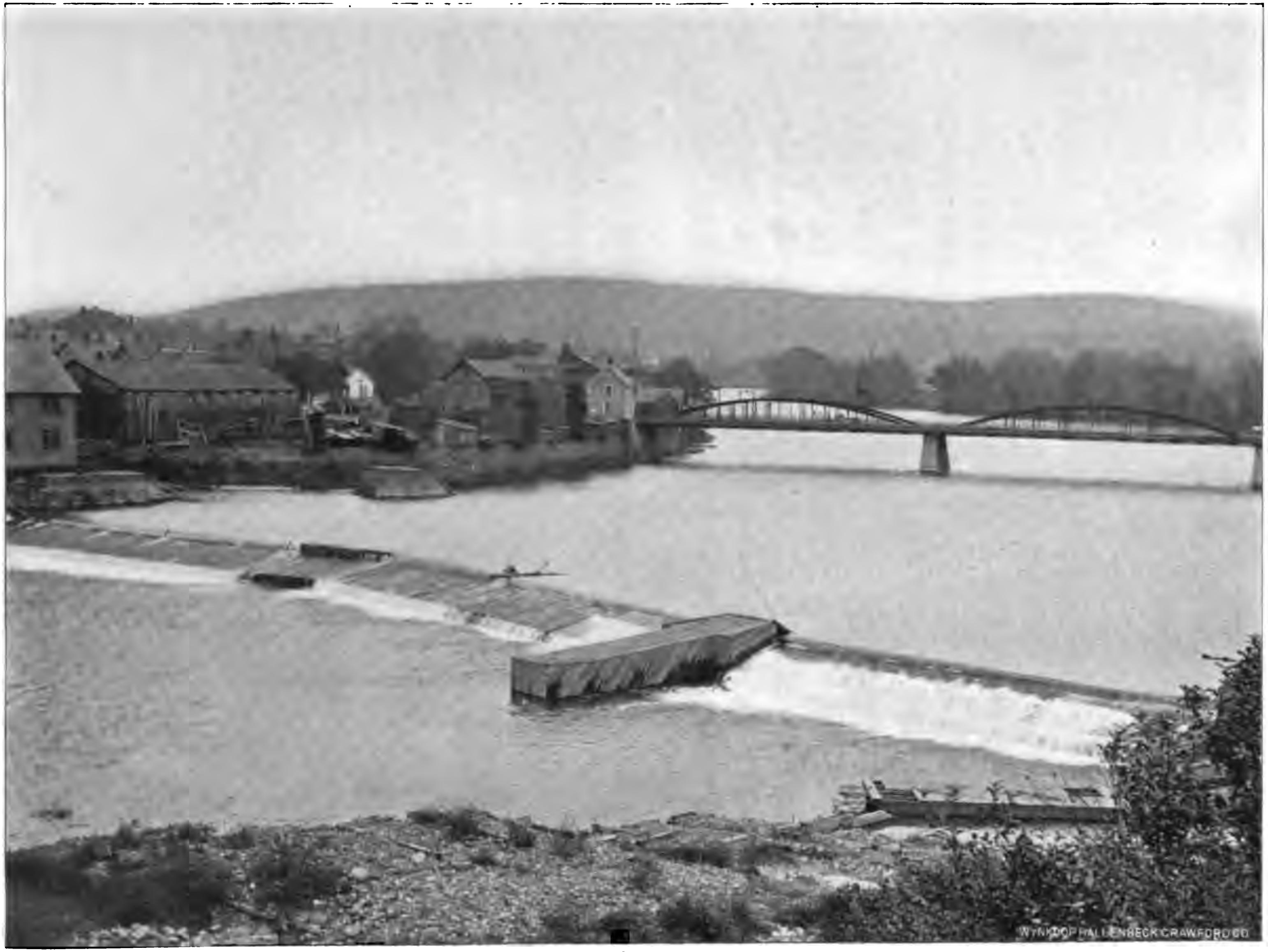
"No. 7. And further to make inquiries and ascertain the best mode of constructing fishways over said dams.

"No. 8. The expense of the same.

"No. 9. And such further facts touching fishways and their usefulness in aiding the passage of fish over obstructions as said Commissioners may deem useful or expedient."

The Commissioners were apparently in doubt about the legal status of fishways and applied to John A. Loring for an opinion, who said: "By the law of this Commonwealth, all persons who may build dams on streams annually frequented by fish, do so under an obligation to keep open sufficient sluices and fishways for the passage of fish at proper seasons. And a company whose charter makes no provision for such fishways in dams which they build, is under this obligation as much as if such charter in terms required fishways to be built."

The report itself with plan of a fishway is very comprehensive and shows clearly the need of fishways to maintain a supply of certain of our food fishes, and it is referred to here simply to show that the Commissioners at that time realized the importance of constructing passes over river obstructions to enable food fishes to



UP-STREAM VIEW OF ROGERS FISHWAY IN SUSQUEHANNA RIVER AT BINGHAMTON.

ENTRANCE TO FISHWAY, AS INDICATED BY CROSS.

reach their natural spawning grounds from which they had been cut off by the erection of dams for power purposes. Long before the State of New York had a Fisheries Commission to make a report to the Legislature, the law-making body had enacted, viz: in 1801, "that no dam should be erected on streams flowing into Lakes Ontario, Erie or Champlain, to prevent salmon from following their usual course up said streams, and when dams were erected they should be provided with fishways to enable fish to pass over the obstructions."

In the first report of the Fisheries Commission of the State of New York the subject of fishways is treated seriously, and the Commissioners say, "If any State erects an impassable dam across the stream between their spawning beds and their winter resorts, they (the fish) will disappear utterly." This refers to salmon chiefly. The New York Commissioners were also in doubt about the legal status of fishways in dams because of an adverse decision by the Courts of Pennsylvania construing a statute in that State requiring dam owners to erect fish passes in their dams.

The Fish Commissioners of Massachusetts made a case against the owners of a dam across the Connecticut river and it was carried through the State Courts and to the United States Supreme Court and the following is an extract from the decision of that Court:

Rivers, though not navigable even for boats or rafts, and even smaller streams of water, may be and often are regarded as public rights, subject to legislative control, as the means for creating power for operating mills and machinery or as a source for furnishing a valuable supply of fish suitable for food and sustenance. Such water-power is everywhere regarded as a public right, and fisheries of the kind, even in waters not navigable, are also so far public rights that the Legislature of the State may ordain and establish regulations to prevent obstructions to the passage of fish, and to promote the usual and uninterrupted enjoyment of the right by the riparian owners.

Proprietors of the kind, if they own both banks of the water-course and the whole soil over which the water of the stream flows, may erect dams extending from bank to bank, to create power to operate mills and machinery, subject to certain limitations and conditions, and may also claim the exclusive right of fishery within their territorial limits, subject to such regulations as the Legislature may, from time to time, ordain and establish. Persons owning the whole of the soil constituting the bed and banks of the stream, are entitled to the whole use and profits of the water opposite their land, whether the water is used as power to operate mills and machinery or as a fishery, subject to the implied condition that they shall so use their own right as not to injure the concomitant right of another riparian owner, and to such regulations as the Legislature of the State shall prescribe.

Evidently the right of fishery, as well as the right to use the water of a stream for mill purposes, is the subject of private ownership, and when held by good title, the one as much as the other is a vested right, and both alike are entitled to public protection, and are subject, in a certain sense, to legislative regulation and control. Difficulties, in every case, attend the proper adjustment of such rights, as the complete enjoyment of the one may interfere with the corresponding enjoyment of the other, but the presumption is, in construing any regulation upon the

subject, that the framers of the regulation did not intend to allow either party to disregard the rule that he should use his own property as not to injure the property of the owner of the other right.

Ownership of the banks and bed of the stream, as before remarked, gives to the proprietor the exclusive right of fishery opposite his land, as well as the right to use the water to create power to operate mills, but neither the one nor the other right, nor both combined, confer any right to erect obstructions in the river to prevent the free passage of fish up and down the river at their accustomed seasons, as such obstructions would impair and ultimately destroy all such rights owned by other proprietors both above and below the obstruction on the same stream. Fish rights below a dam, constructed without passageways for the fish, are liable to be injured by such a structure as well as those owned above the dam, as the migatory fish, if they cannot ascend to the headwaters of the stream at their accustomed seasons, will soon cease to frequent the stream at all, or in greatly diminished numbers.

In 1892, chapter 488 of the Laws of that year, the State of New York passed a fishway law which was amended by chapter 974 of the Laws of 1895 and added to by chapter 408 of the Laws of 1898, and now reads as follows in the Fisheries, Game and Forest Law:

ARTICLE XI.

FISHWAYS.

Section 260. Commissioners to be notified of construction of dam.
261. Authority of commissioners to direct fishways.
262. Owner to comply with direction of commissioners.
263. Commissioners to recover for construction and penalty.

Section 260. *Commissioners to be notified of construction of dam.*—No dam shall be constructed by the state or any person upon any stream more than six miles in length inhabited by fish protected by this act, until the person about to construct, or the officers having charge of the construction of the same shall give written notice to the commissioners of such intention, together with a statement of the name, length and location of said stream, and the size and general description of such dam, and the purposes for which it is to be erected, together with a diagram thereof.

Section 261. *Authority of commissioners to direct fishways.*—The commissioners are authorized in such cases to direct the construction of suitable fishways by an entry on their minutes and service of a copy of such order on the person constructing or officers having charge of the construction of such dam, and the person so constructing shall at his own expense, or the officers having charge of the construction shall, out of the funds appropriated for the construction of such dam comply with such directions, subject, on application on notice as on a motion, to the right of the supreme court to affirm, reverse, modify or alter such directions.

Section 262. *Owners to comply with directions of commissioners.*—Such fishways shall be properly maintained by the owner or persons in possession of such dam, and shall be subject to examination and inspection on behalf of the commissioners, who may direct such repairs and alterations as they may deem necessary, subject to the order of the supreme court, as in case of construction.

Section 263. *Commissioners to recover for construction and penalty.*—In case of failure, refusal or neglect on the part of any person to comply with the directions of the commissioners as to building and repairing fishways, the commissioners may cause such fishways to be constructed or repaired, and the expense thereof may be recovered by the commissioners in an

DOWN-STREAM VIEW OF ROGERS FISHWAY IN SUSQUEHANNA RIVER, AT BINGHAMTON.

CONSTRUCTED UNDER THE DIRECTION OF THE FISHERIES, GAME AND FOREST COMMISSION.

action against the owner or person in possession, or both, in the name of the people, and shall, in addition to the personal liability of such owner or person in possession be a lien upon the premises upon which such dam is situated. The person refusing or neglecting to comply with such directions of the commissioners as to construction or repairs shall also be liable to a penalty of ten dollars for each day during which they neglect to obey such directions, which penalty may be recovered in like manner in the same or a separate action.

Section 264. No person or persons, association, corporation or company shall build, place or maintain any rack, screen, weir or other obstruction across any of the creeks, streams or rivers of the state inhabited by fish protected by law that will prevent the passage of fish from one point to another point in said waters except as provided in section one hundred and forty-three of the fisheries, game and forest law. Whoever shall violate or attempt to violate the provisions of this section by placing, maintaining or causing to be placed or maintained any rack, screen, weir or other obstruction to prevent the passage of fish as aforesaid shall be deemed guilty of misdemeanor and in addition thereto shall be liable to a penalty of fifty dollars for each rack, screen, weir or other obstruction built or maintained in violation of this section.

The exception referred to as provided in Section 143, is a provision for maintaining eel weirs in certain waters.

In addition to what is known as the Fishway Law, quoted in full above, chapter 498 of the Laws of 1895, provides for the construction of fishways in private dams in the counties of Saint Lawrence and Franklin.

In consequence of the fishway laws quoted and referred to, now in force in this State, the Fisheries, Game and Forest Commission is often appealed to for information in regard to a form of approved fishway and for other information in regard to such fish passes, and this article is written to describe, with accompanying illustrations, the forms of some of the best working fishways. The fishway, fish pass or fish ladder is more than a hundred years old in its salient features, and as its various names imply, is to enable fish of different species to pass over natural and artificial obstructions in a stream to reach spawning grounds, better pasturage or escape from foul waters. More than fifteen years ago the United States Fish Commission gave as a remedy for the decrease in the food fish supply this formula:

First. Enactment of such legislation as will control excessive fishing, and prohibit destructive methods. *Second.* Compensating for the insufficient natural supply by artificial propagation and planting. *Third.* Extending the area of breeding and feeding by overcoming natural obstructions by means of fishways.

The first and second propositions have been adopted and practiced most vigorously, while the third, equally important in many respects, has been adopted only spasmodically. There will be no attempt here to enumerate all the different forms of fish passes, most of them patented, and several of them differing but little in design, that have been or now are in use in the United States, but the Brackett, the Pike, the Foster, the Atkins, the Swazey, the Brewer, the McDonald, Cail's improved, and the Rogers, are the better known.

The object sought in each is to retard the flow of water on an enclosed incline plane, chiefly, with "buckets," steps or falls, creating "pools" of water flowing with moderate velocity through which the fish may swim easily from bottom to top over the obstruction in which the fishway is erected.

In building a fishway it must be constructed with sufficient strength to resist floods and ice in the breaking up of the stream in spring, and in some instances protected against damage by log drives.

Properly constructed a fishway adds strength to a dam, instead of weakening it as is sometimes supposed. In locating a fishway the entrance must be so placed that fish can find it easily, and this is best done by making the entrance at the base of the dam as is shown in the illustrations; and the flow of water must be of sufficient volume to attract fish to it and enable them upon entering, to swim through it and at the same time there must be no unnecessary waste of water. As a rule, however, fishways are only used by fish when the stream is in moderate flood and water is wasting over the dam in which the fishway is constructed.

By entrance to the fishway I mean the down-stream end of it, for I seriously doubt if young or adult fish resort to a fishway in descending a stream unless they chance upon it because of the current which it may create. An enclosed fishway should be constructed to admit light from top and sides, for some species of fish are extremely timid and hesitate to enter a dark fishway. This is particularly true of shad and, in fact, I do not know of shad passing through a fishway in any considerable numbers except in one instance, and even that is disputed; but the proof seems to me sufficient to establish the fact that shad have passed through fishways in Lackawaxen dam, in the Delaware river. This is a folding dam and is raised only at certain seasons and stages of water, and upon visiting the dam to examine the fishways I found a divided opinion concerning their efficiency, some contending that the shad passed up-river before the dam was raised, and others that the shad did not pass after the dam was erected until the fishways were constructed.

Seventy-five miles further up-stream, I found, upon questioning disinterested witnesses, that shad did not run to that point after the construction of the dam, as they did formerly, until the fishways were built, when the shad run was resumed as in the years before the dam was erected.*

* Since the above was written I have met Mr. J. R. Peck, Tax Agent of the Delaware and Hudson Company, who told me that he had seen a solid mass of shad in the Lackawaxen fishways on the Pennsylvania side of the river during the shad run, the shad passing through as rapidly as the crowding of a great number of fish at the entrance of the fishway would permit. Further, I desire to put on record that Mr. Peck informed me that the shad did not use the fishway on the New York side of the river, but all passed up over the dam on the Pennsylvania side, and his statement was based on personal observation.

ORIGINAL McDONALD FISHWAY WITH WATER SHUT OFF, IN GREAT FALLS OF THE POTOMAC.

The interior of an enclosed fishway should be large enough for a man to pass through for inspection and repairs or cleaning, and be constructed as simply as possible and at the same time permit it to perform its office, that fish may pass through without encountering complicated details of construction to confuse them and which serve chiefly to catch drift that clogs the "buckets" and "stops," and renders the fishway useless for the purpose for which it was built. The slope of a fishway must also be considered carefully in its relation to the height of the dam. The earlier fishways were built with a rise of but one foot in from ten to sixteen, and one dam twenty-nine feet high had an inclined fishway 450 feet long, and it was calculated that a fish in passing through it would have to travel 1,500 feet in following the devious channel caused by the arms or buckets projecting from either side of the interior of the pass to retard the flow of water. This, however, must have been an improvement upon a natural fishway that I once examined. An application had been made to this Commission for permission to build a dam on a large stream in the State and the Commissioners referred the application to me for an examination and report. The manager informed me that no fishway would be required as the dam itself would contain a number of natural fish passes. These I found to be gates at the base of the dam and on a level with the river bottom, to let off the water when it reached a certain height in the pond, and I asked what the pressure would be to the square inch. "What has the water pressure to do with it?" "Everything; as it will determine whether or not you will have to build a fishway over the dam."

That was something which had not been thought of, and as the water pressure would be over nine pounds to the square inch with the water level with the crest of the dam, and it was not proposed to open the gates until the water was about two feet above it, there is now a very substantial fishway over the dam.

The rise in Cail's improved fishway is one foot in four without reference to the height of the dam in which it is built; but it is different in construction from any other shown in the illustrations. The rise of the slope in the McDonald fishway is

There were originally four fishways in this dam built jointly by the State of Pennsylvania and the State of New York, and when they needed to be repaired, the Pennsylvania Fish Commission notified the Fisheries, Game and Forest Commission and the matter was referred to me for an examination of these fishways and a report. The examination proved to my own satisfaction that the shad would naturally follow the Pennsylvania shore rather than the New York shore, and furthermore that two fishways, on the Pennsylvania side, were sufficient to pass the shad above the dam and New York received little, if any, benefit from shad going above the dam, and my report embodied these opinions with the recommendation that any available money for fishways should be spent in erecting them where they would more certainly benefit the people of New York State. My report, adopted by this Commission, was a disappointment to my friend, the late Mr. Ford, who was then President of the Pennsylvania Commission; but I am glad to be able to record Mr. Peck's statement, even at this late day, showing that the report was well grounded, and the opinions therein, now confirmed by facts not obtainable at the time of the examination, justifies the action of this Commission. A. N. C.

based upon its width, and for small fishways of this kind the inventor, the late Colonel Marshall McDonald, formerly Commissioner of Fisheries of the United States, furnished this table:

Width,	12 inches,	slope,	1 foot in	2,
"	18 "	"	1 "	3,
"	24 "	"	1 "	4,
"	30 "	"	1 "	5,
"	36 "	"	1 "	6.

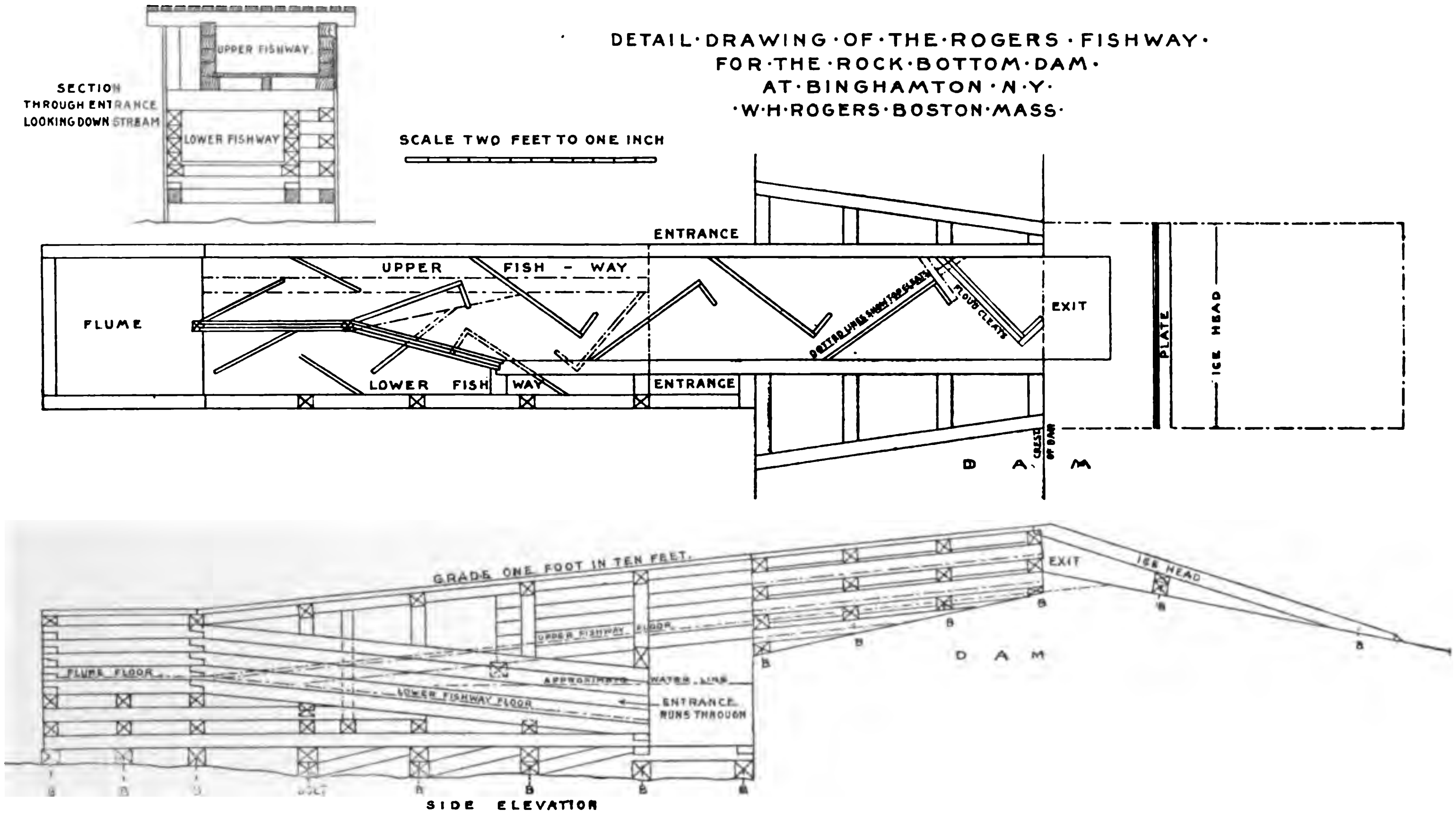
The original McDonald fishway was entirely different in principle from any of the others named, and in its modified form uses iron buckets as shown in the illustration of a section of a twenty-four-inch fishway. The Rogers fishway may be constructed in several different ways, but the one shown in the half-tones of the Binghamton fishway, of which there is also a plan of construction on another page, is perhaps the best form for ordinary dams, as the entrance is at the base of the dam and the incline leads down stream to a pool inside the enclosed structure, and then turns up stream, over and a little at one side of the lower passage, and the fish find exit over and above the dam. The slope in this form of fishway is arranged to meet the necessary requirement in the case of each particular dam under consideration.

The power of fishes to surmount obstructions in a stream such as falls or dams, is very limited except in the case of members of the salmon family.

The salmon (*salar*, its specific name, from *salio*, to leap) is a born jumper, and with a deep pool to start from at the base of a waterfall, will, when ascending a river to spawn, jump over obstacles that seem impassable for any fish. Dr. Landmark, Inspector of Fisheries of Norway, conducted some experiments for the Norwegian Government to test the power of the salmon in this respect, and when extracts from his report were translated and printed in English, they gave rise to considerable discussion on the subject in this country. Dr. Landmark wrote me as follows in 1894:

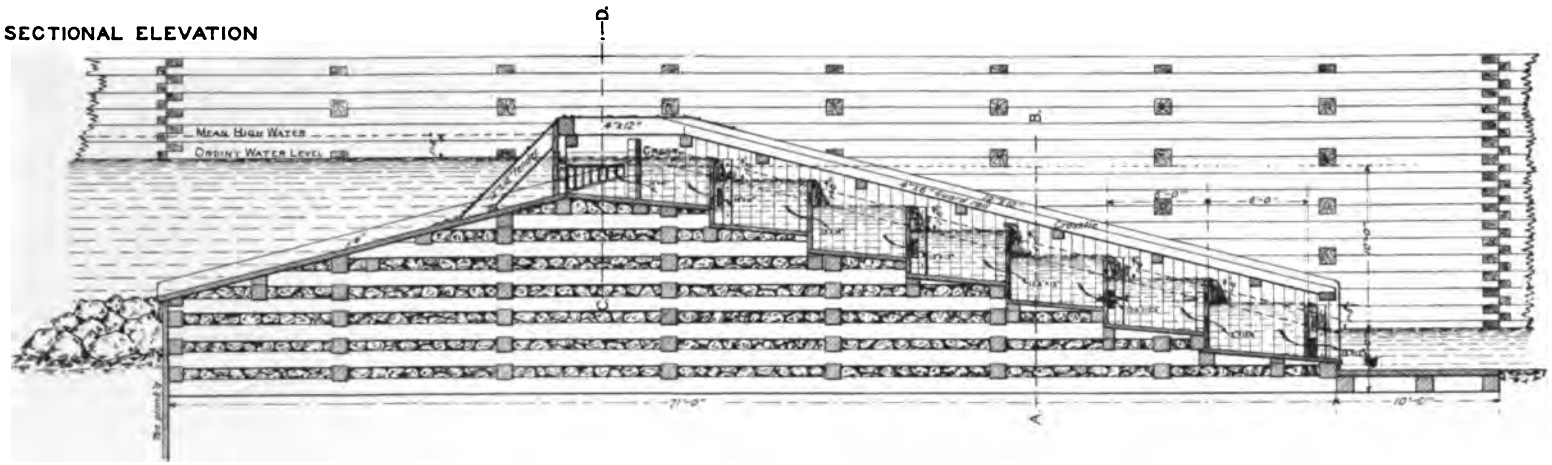
> Concerning the height that salmon can jump under favorable circumstances, there is one place in Norway with indisputable evidence that there salmon have sometimes made a perfectly clear jump of sixteen feet perpendicular height. * * * No doubt a jump of the said height is quite unusual; but, having myself examined the spot where the occurrence has taken place, and having heard the evidence of persons who have themselves witnessed it, I cannot doubt the fact.

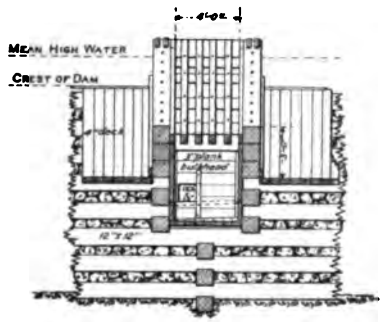
Since Landmark's experiments, Dr. Robert T. Morris, of New York city has seen salmon in the act of jumping over falls on rivers in Labrador that were from twelve to eighteen feet high and has photographed the fish, a half dozen of the pictures being before me, in the air as they made the leap and has measured the falls at the point where the jump was made.



PLAN OF CONSTRUCTION ROGERS FISHWAY.

TOP AND SIDE COVERING NOT SHOWN.





SECTIONAL ELEVATION AND CROSS SECTION IMPROVED CAIL SYSTEM FISHWAY.

APPROVED BY UNITED STATES FISH COMMISSION.

Our native trout will also make its way over obstructions that seem little less than marvelous and swim up and over a dam in a sheet of water that falls vertically if the sheet of falling water is thick enough, but if the fins pierce the water and encounter only the air the fish falls to the bottom only to try the ascent again.

Neither salmon nor trout can make a high jump vertically and at the same time laterally, and so a dam with apron projecting down stream is a bar to the ascent of these leaping fish and fishways must be built in them if the fish are to get above them. A very slight vertical waterfall will stop black bass or the so-called pickerel, properly, the pike, although both fish will fight their way up in a torrent of rushing water that appears to be swift and strong enough to the observer to drive everything of fish kind far down stream and away from its fierce boiling pools. Fish quickly avail themselves of the benefit to be derived from a fishway.

At Mechanicsville, on the Hudson, when a fishway was built a little water was allowed to run through it to test it and a salmon came into it before the workmen got out. On shutting the outlet of the same fishway, to clean it later, over sixty black bass and a number of pike-perch were found inside of it and water enough remained in the buckets to preserve the fish so they were not lost. When I went to Binghamton with the builder of the fishway to locate it, men and boys lined the dam at low water and were catching small black bass which gathered just below the apron and could get no further. It was estimated that as high as 800 bass had been taken in one day from the dam and the fishing went on day after day without ceasing, and few of the bass I measured were more than eight or nine inches long; if they came within the legal limit of eight inches they went on the "string."

The building of a fishway stops such destruction, for, even if the fish do not use the pass, there can be no fishing legally within fifty rods of a fishway, as witness Sections 117 and 118 of the Fisheries, Game and Forest Law:

Section 117. *Signboards near fishways.*—The commissioners of fisheries, game and forest are required to maintain, fifty rods from any fishway erected by the state, and on both sides of the stream, signboards containing substantially the following notice: "Fifty rods to the fishway; all persons are by law prohibited from fishing in this stream between this point and the fishway." The provisions of this section shall apply to public waters only.

Section 118. *Fishing near fishways prohibited.*—Fishing or attempting to take fish by any device whatever, within fifty rods of such fishway, erected by the state, and any interference with the signboards there maintained by the commissioners of fisheries, game and forest, is forbidden. Whoever shall violate or attempt to violate the provisions of this section shall be deemed guilty of misdemeanor and in addition thereto shall be liable to a penalty of twenty-five dollars for each violation and ten dollars for each fish so taken, killed or possessed.

But the fish do use the fishway, for when I went to Binghamton with a Division Engineer of the State to accept the fishway, and the head gate was closed, black bass

were found inside, caught as they were passing through by the act of shutting off the water, and the swarming of the fish at the foot of the dam was a thing of the past. In a book recently published in London, the author, Sir Herbert Maxwell, Bart., under the heading "The creation of new fisheries," says:

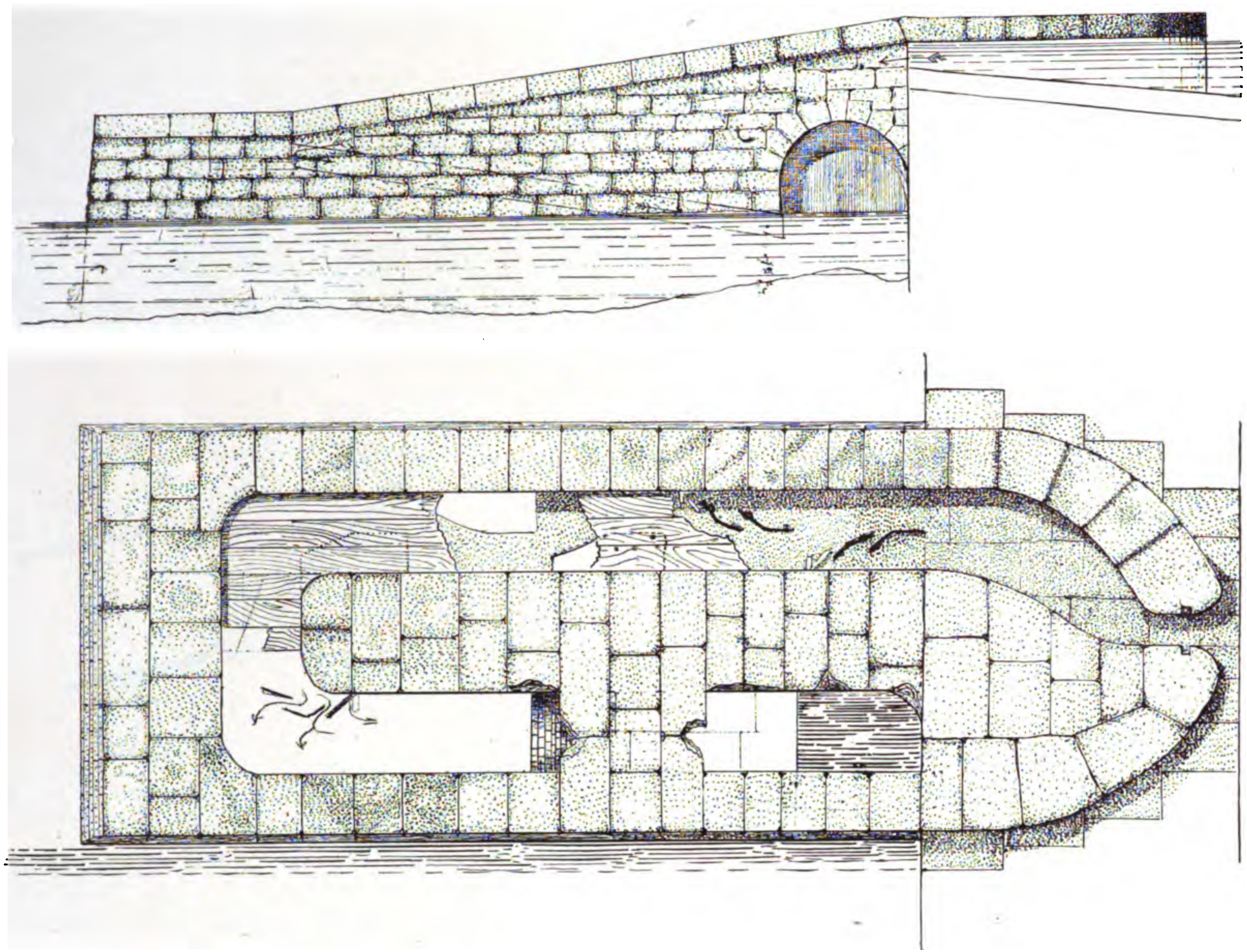
> The rivers Avonmore and Arrow form a junction in County Sligo, composing the Ballisodare river, which is interrupted by falls utterly impracticable for salmon. The proprietor constructed a series of ladders or fish passes over these falls. * * * After the ladders were built spawning salmon were put in above Collooney (falls) with the result that twelve years later 9,750 salmon, valued at about £3,000, were taken in the fishing weir at Ballisodare. The original cost of the ladders was about £1,000 which, it will be admitted, was a moderate outlay to secure such a large income, besides the value of the sporting advantages created.

The illustration of the Irish fish ladder referred to shows it to have been built of masonry, open at the top, with arms projecting inwards from alternate sides until near the exit at the crest of the dam where the arms extend entirely across the inside of the pass forming bulkheads with square openings on alternate sides near the floor, after the manner of the openings in the improved Cail system, shown in the accompanying illustration. An annual income of $15,000 from building a fishway at the cost of $5,000 is a fair investment, to say nothing of the sport which it produced.

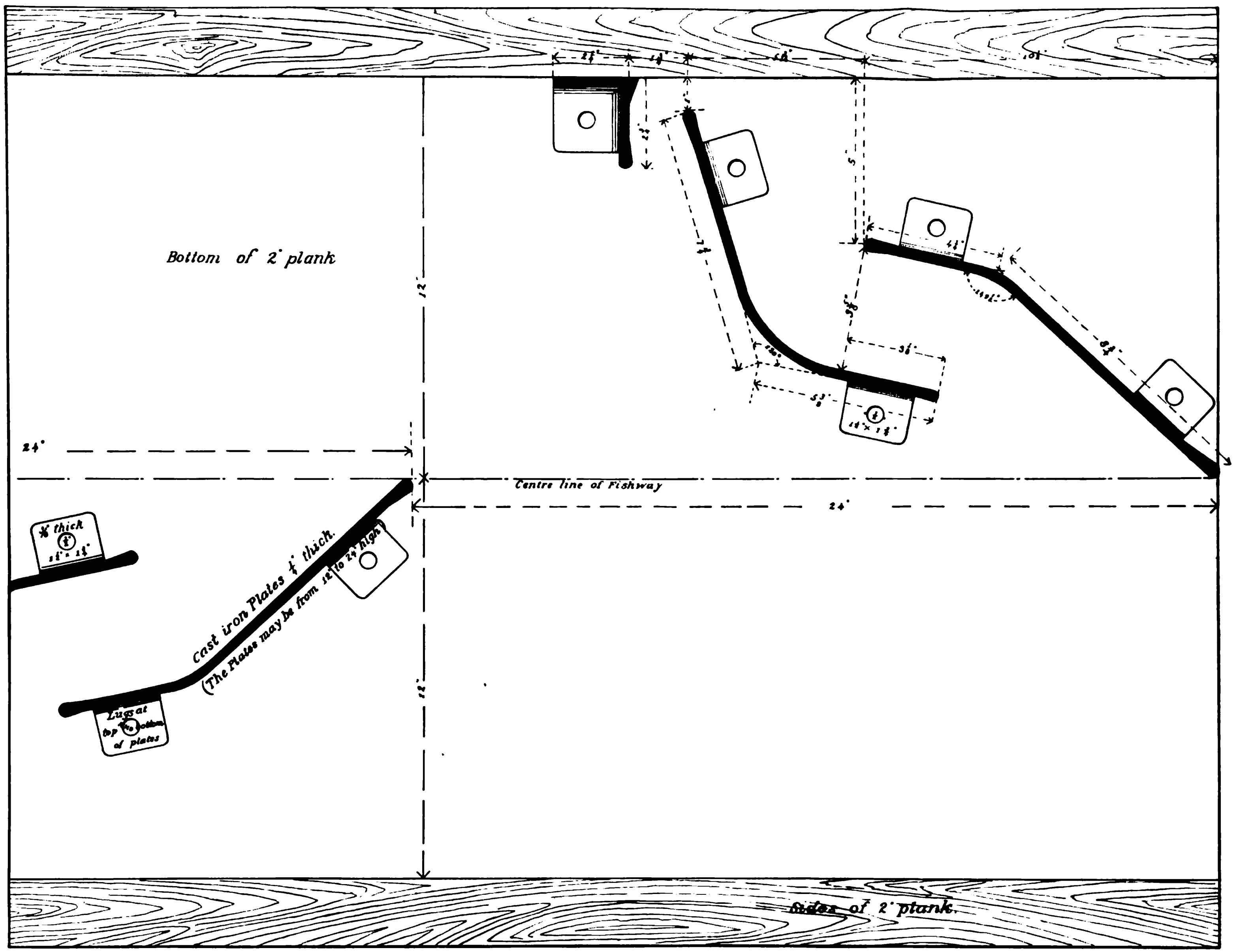
As to the material of which fishways should be constructed, masonry is, of course, the best, if it were not for the cost; and I doubt not that in the end it would be cheaper than wood.

The illustrations of the study of a fishway for the Vienne river, France, and of the Great Falls fishway in the Potomac, are introduced here to show the stability and permanence of such structures when built of masonry, or masonry and iron—as are all the European fishways. Our fishways are, almost without exception, built of wood, the Binghamton fishway being a fair example. The crib in that structure is filled with stone to anchor it; the timbers are bolted to the bottom and the planking is three-inch oak, well spiked to the timbers. The ice head is covered with a solid sheet of three-eight-inch iron bent to conform to the incline and securely bolted. A field of ice coming down stream would run up on the ice head, at proper stage of water, project beyond the apex and break of its own weight. The whole structure seems massive and durable; and it is, until the wood rots or bolts rust, and then, if not promptly repaired, general decay sets in and destruction follows.

For this reason it is probably cheaper in the end to construct a fishway, the exterior anyway, of masonry at the outset, except in small streams not visited by severe and powerful freshets and heavy ice, in which case a straight chute with vertical sides, and arms cleated to the bottom from alternate sides, which can be completed for a comparatively small sum, will serve the purpose to pass trout over a dam with



FROM ORIGINAL STUDY FOR FISHWAY ON RIVER VIENNE, FRANCE, BY MARSHALL McDONALD. PLAN AND SIDE ELEVATION.



SECTION OF STANDARD McDONALD FISHWAY, SHOWING MANNER OF PLACING IRON BUCKETS.

apron, for it is always the apron projecting down stream from the crest of a dam, that stops the jumping fish. At Mechanicville, on the Hudson, the year before the fishway was built, the salmon, from plants made in the upper waters, by the Fish Commission of this State, of fry hatched from eggs furnished by the United States Fish Commission, gathered in considerable numbers below the dam (without an actual count, I think there were 150 adult fish in a pool at one time), which they could not pass. The water was shallow at the base of the dam and the fish could not get a fair start for a leap, but leap they did, repeatedly, several being in the air at the same time, until some killed and others injured themselves by striking on the apron thinly covered with water.

Already I have told how quickly the fish availed themselves of the fishway when it was built; and later in that season when the water was low and there was quite a gathering of salmon at the mouth of a cool stream coming into the main river a short distance below the dam, there came a heavy rain which raised the river and filled the fishway, and, in six hours after there was not a salmon to be seen in the river below the dam, as all had passed on up-stream through the fish pass provided for them.

As to the cost of fishways, there can be no hard and fast rule, as conditions vary with different obstructions and each dam and fall should be considered by itself and estimates made upon existing difficulties that are to be overcome. Then, too, the time of building a fishway must be considered. When the water is low, in mid-summer, and the builder is reasonably sure of escaping freshets that may carry away his half-finished work, the cost is less if the work is done by contract, then when the work is undertaken in the autumn at a time when floods may be expected, even if they do not come.

The Binghamton fishway, of which there are two illustrations in this paper, cost $2,000 and was built in the autumn at a time when the contractor did not wish to undertake it as he had good reason to expect high water before he could complete it. As it proved, the high water did not come until the work had progressed beyond the danger point and he made money, as his contract price was based upon possible injuries to a partly finished structure which he would have to replace at his own expense. Rough figures of the cost of Rogers fishways in dams of given height may be given as follows:

5 to 7 feet high,	. . . .	$1,200	to	$1,800
8 "	. . . .	1,800	"	2,000
10 "	. . . .	2,000	"	2,500
12 "	. . . .	2,500	"	3,000
14 "	. . . .	3,000	"	3,500
16 "	. . . .	3,500	"	4,000

These I imagine to be outside figures subject to considerable modification when existing conditions are actually known and the time of building the fishways can be selected by the builder.

The improved Cail fishway is one that has not been used in this State and I know little about it except that it has been approved by the Commissioner of Fisheries of the United States, which is all-sufficient to warrant its adoption where a fishway is needed. It has one very marked feature in its favor, and that is cost of construction.

Upon this point I have received an informal letter from the United States Fisheries Commission as follows:

> The Cail fishway, as modified by Mr. Von Bayer, our engineer, is believed to be a most effective form of fish pass, but we have not had an opportunity of practically constructing any of them; consequently, any information we may give you on this subject will be purely speculative. The construction of a fishway always depends upon the character of the dam in which it is to be constructed. For example, in a well-built crib dam where there are only a few stones to be removed, etc., Mr. Von Bayer thinks $300 would cover the cost of a wooden fishway in a dam ten feet high. In favorable conditions the cost would increase in proportion to the height, that is, twenty feet high would cost $400 to $500.

Certainly this form of fishway costs much less than any that I have mentioned, and if upon actual trial it proves to do the work for which it is intended, as well as any other style of fishway, the cost of construction will be greatly in its favor. The illustration of sectional elevation and cross section will show how the fishway is constructed, except as hereafter explained. It will be seen that instead of arms or buckets the flow of water is moderated by a series of bulkheads. The floor of the compartments formed by the bulkheads should be laid slightly inclined and the bulkheads are placed obliquely across the fishway. Each bulkhead has an aperture in alternate ends and they increase progressively from the lower to the upper ones.*

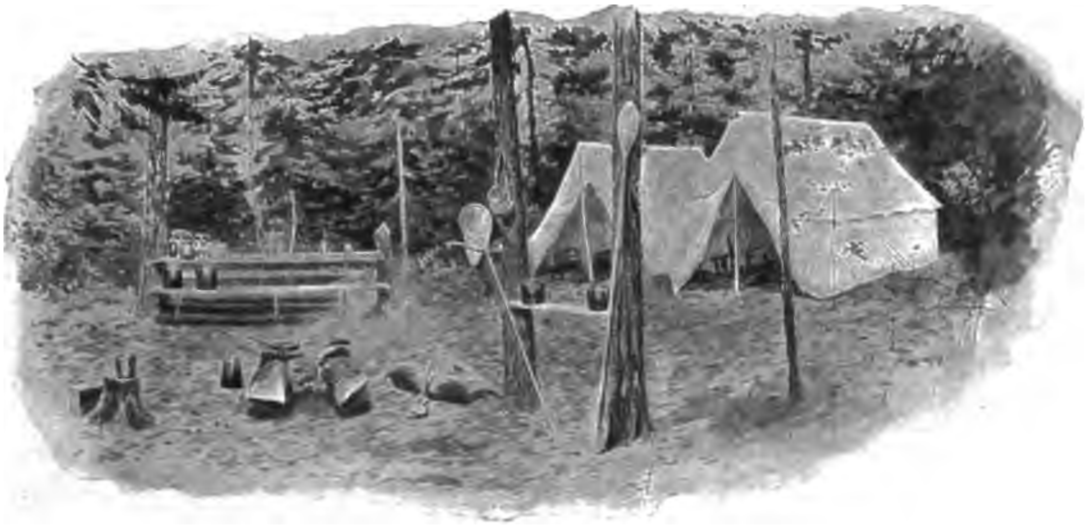
No regulating device or head gate is required at the intake and light is admitted to the fishway from the top. The hydraulic head between two successive compartments must be so chosen as to obtain a current velocity through the aperture of not to exceed ten feet per second. Fish may pass through the aperture or jump the bulkheads as is shown in the drawing of sectional elevation.

---

* Since the illustration of the improved Cail fishway was engraved, for this report, it having been made from plans furnished through the courtesy of Hon. George M. Bowers, United States Fish Commissioner, Mr. Von Bayer, the Engineer and Architect of the Commission, writes me as follows: "Referring to the plans of an Improved Cail Fishway lately sent you, you are advised that the aperture in the uppermost cross bulkhead of the fishway marked on the sectional elevation under the word "Crest" 15" x 15" should be 18" x 18". This letter was received too late to make the change in the illustration as the impressions for the entire edition of this report had been printed. A. N. C.

The building of fishways has never in this country received the attention that the subject deserves and the cost of construction of such means for fish to find proper spawning grounds, better pasturage and purer water and to spread staple food for the people over a greater area, is a good investment because of the benefit which will surely be derived from it. European fishways have been constructed chiefly for the passage of salmon, and, in fact, the early fishways in this country were designed almost entirely for this fish, until the belief prevails that fish passes are necessary only for anadromous fish. This idea is entirely wrong, for where fishways have been constructed in this State nearly all our fresh-water food fishes—black bass, pickerel, pike-perch, bullheads, rock bass, yellow perch, suckers, etc., have availed themselves of such means to find new spawning grounds or more food, so that fishways are often necessary for our common fish that never go to salt water.

A. N. CHENEY,
State Fish Culturist.



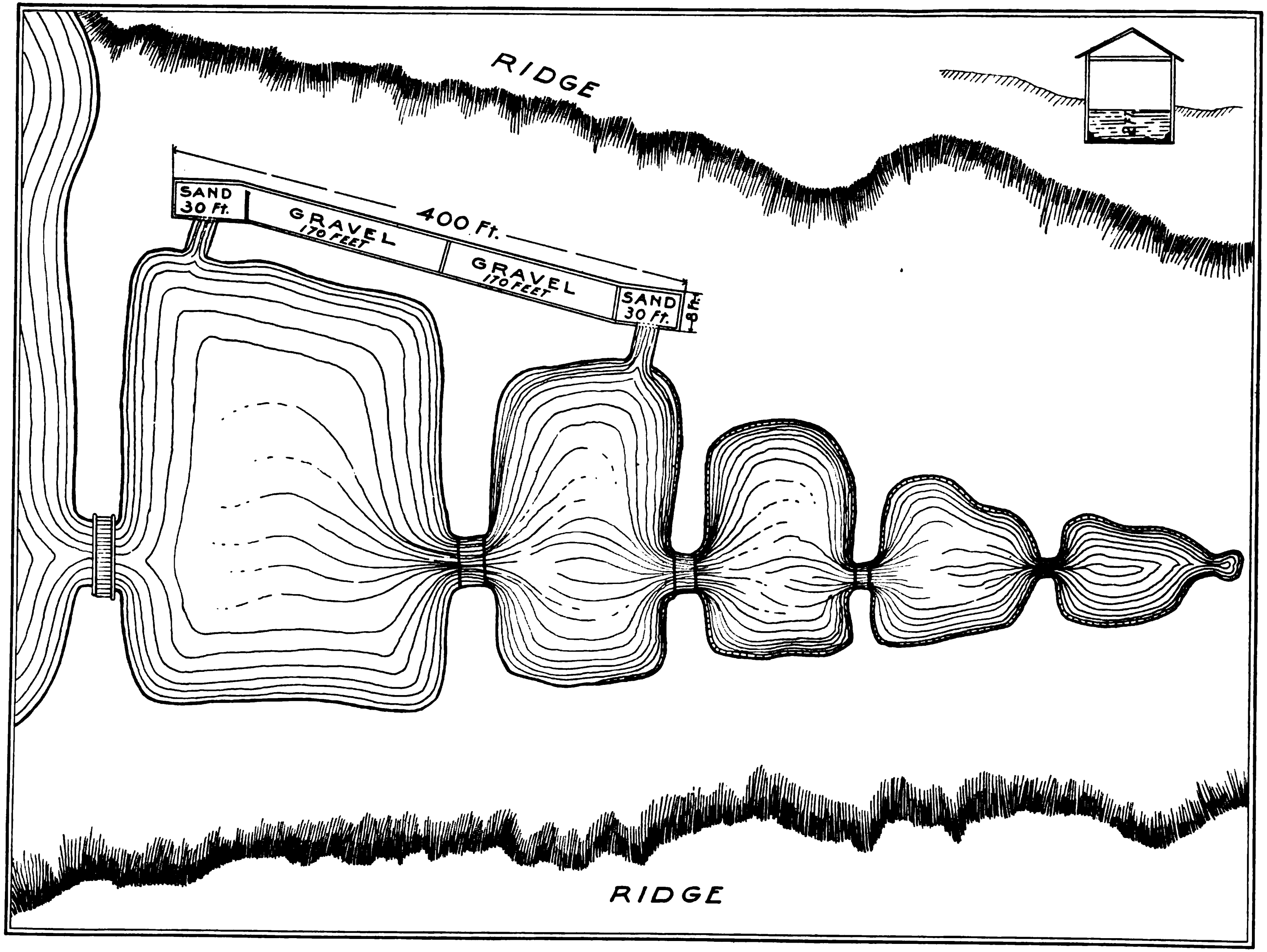
ROOMS ON THE FIRST FLOOR.

A Natural Hatchery for Trout.

THE END OF THE LEAPERS.

THIS paper is written to describe a hatchery in which trout eggs are hatched by natural processes, although the fish are under restraint, and the term natural hatchery is used in contradistinction to artificial hatchery in which trout eggs taken from the fish by hand are hatched on trays in troughs of running water and constantly watched by hatchery attendants. In a natural hatchery the trout are not handled by men during the spawning season; and the eggs, after they are deposited naturally, and the fry after they are hatched, are unmolested as much as though the fish were wild fish spawning in wild waters, until such time as the fry are removed from the hatchery to the rearing ponds to be fed and grown to fingerlings or larger fish. In State work, where every year there is a greater demand for trout fry and fingerlings than the State can supply, every egg that can be obtained is utilized and every possible effort is made to obtain eggs outside of those furnished by fish in the stock ponds at the various hatcheries. Wild waters are drawn upon, and a few private waters, controlled by individuals or associations, furnish trout eggs to the State with the understanding that a certain per cent. of the fry shall be returned to their waters, while the State has the balance for general distribution. Under these circumstances a natural hatchery would not serve the purposes of this Commission, for it is not pretended that in a natural hatchery economy is practiced in the number of eggs obtained from the fish or the number of fry hatched from the eggs. By law the Fisheries, Game and Forest Commission is forbidden to plant fry or fish reared at the expense of the State in waters closed to public fishing, and owners of private preserves, if they wish to add to their stock of fish, must buy them or rear them.

To erect a hatchery on the plan of a State hatchery, even though it be on a much smaller scale, is expensive, and to spawn fish artificially, and care for the eggs and fry



PLAN OF NATURAL HATCHERY WITH CROSS SECTION, AND SERIES OF TROUT PONDS.

for a period of several months requires constant labor, and labor means an outlay of money. Only experienced men can do the work well, and in the best equipped and best managed hatcheries, unforeseen accidents may arise and disease may appear, and often it is cheaper to buy trout than to rear them.

A hatchery that runs itself, with no artificial spawning, no egg picking, no pipes to repair or replace, no heat to maintain to warm the men employed, no troughs to tar and no trays to renew; in short, a hatchery with no men or troughs or pipes or heat in it is quite a different matter, and one that may be considered when the other is out of the question.

During the past year I have received inquiries from more than a dozen different sources, two from fishing clubs in Canada, upon the subject of inexpensive fish hatcheries that may be maintained at moderate cost, and I have selected one of two natural fish hatcheries belonging to fishing clubs on Long Island to be illustrated and described to answer the inquiries, and doubtless other clubs or owners of private fish preserves may see in such a natural hatchery the means of keeping up the fishing in or re-stocking their waters.

Trout are cannibals, and when confined in circumscribed waters, lacking an abundance of food, eat the ova of one another from the spawning beds and the fry of all indiscriminately to a greater or less extent. Most of such casualties are obviated in a natural hatchery. The hatchery here described and illustrated was designed and constructed by Commissioner Edward Thompson, the Shellfish Commissioner of this State, and I know of but two more like it, both constructed under his direction; and it is as simple in its operations as A, B, C, for you have only to lift a screen at the proper time and the trout and the water do the rest. The ponds shown in the plan in a series were dug in a depression between two ridges and are fed from springs on either side and from an artesian well at the head of the smaller or upper pond. The ponds shown are all used for rearing trout and outlet into a still larger pond, the margin only of which is shown, and in this larger pond the fishing is done by the club members and their guests. The upper pond is used for fry when taken from the hatchery and in this they are fed until they grow to fingerlings and are moved down into the adjoining pond, and as yearlings they go into the next or third pond, or into both according to size, for some grow faster than others and they are sorted to keep the trout of same size in one pond. The fourth and fifth ponds are for two year old fish and they furnish the breeders, as no trout older than two years are now used as breeding fish. These facts concerning the management of the fish in the ponds are mentioned more to explain why there are five ponds in the illustration than with the expectancy that any one desiring to rear trout in a similar hatchery will follow the exact policy of the club owning the ponds. It is true that ponds will have to be

provided in which to rear fry to yearlings, at least, before they are planted in waters to be fished, if the best results are to be obtained from this system of hatching fish, for the young fish must be of sufficient size to be reasonably sure that the greater portion of them will escape the maws of their larger brethren in the water they are to stock.

The hatchery shown in the illustration is 400 feet long and eight feet wide, and a cross section will be found in the upper right hand corner of the plate. At the base of the ridge are a number of springs, which feed two of the ponds, and the hatchery is constructed over them and consists only of a frame of joists, 2 x 5 and 2 x 7, top and sides boarded over, with doors at intervals in the incline of the roof nearest to the ponds. There is a division in the hatchery about midway of its length making one-half of the hatchery a little higher than the other, made necessary by the conformation of the shore. From the bottom of the hatchery to the slope of the roof is about six feet, and two feet of this, or a little more, is beneath the level of the ground. From the midway division, the water as it comes from the springs underneath is directed to flow in opposite directions by the grade at the bottom, and finds its way through sluices with screened gates, into the fourth and fifth ponds. About thirty feet of either end of the hatchery is divided from the balance by upright planks forming a dam, which also holds the gravel in place, with an inch or two of fall and the bottom covered with clean sand, and all that remains is covered with white gravel, well screened, and in size from a pea to a pigeon's egg and ten inches deep; over the gravel the water is six to eight inches in depth, flowing in a gentle current toward the ends. Explicit directions are not given as to kind and sizes of lumber used in the construction of this particular hatchery, as it is expected that any one building a similar hatchery may have to be governed by different conditions from those found on Long Island, but that portion of the structure which comes in contact with the water should of choice be built of pine lumber and tarred with gas tar, or so much of it as is under ground or is washed by the water. Untarred pine may serve if the water is allowed to thoroughly soak the wood before any hatching is done, but tarred wood underground or in the water is preserved for a longer time than untarred, and it is safer for fry. An experiment with new helmlock planks in such a hatchery killed a large number of fry before they could be removed.

The outlets of water at either end of the hatchery form natural spawning races between it and the breeding ponds and in it the movements of the fish may be governed by sliding, screened gates. In the autumn, when the trout, moved by the spawning instinct, crowd into the races, the screens are lifted and they are allowed to make their way into the hatchery and on to the prepared gravel beds. After the trout have spawned, they are driven out of the hatchery through the races back to the

VIEW OF NATURAL HATCHERY ACROSS LOWER TROUT POND SHOWN IN PLAN.

ponds and the screens are closed leaving the naturally impregnated eggs to work out their own salvation in the clean gravel. After the fry are hatched and the umbilical sac with which they are born is absorbed and they are ready to feed, they are induced to leave the gravel beds and find their way in the gentle current down on to the sand, by lifting the doors in the roof and admitting the light from the ends. Once on the sand, the dam formed by the upright planks prevents their return to the gravel; and, whenever it is deemed necessary, they may be moved with net and bucket to a rearing pond outside to be fed until such time as they may be grown to a size suitable for planting in fishing waters or reserved for breeding purposes. In the hatchery that is illustrated, it is estimated that about 300 breeding fish are admitted to the house each year, although the ponds from which they come contain thousands of trout. Those that are denied the convenience of the hatchery spawn in the ponds, and the eggs and fry must submit to risks and perils which abound in such places; but I have been surprised to find that so many fry as I have seen in the ponds in spring and summer have survived the attentions of their parents and relatives.

Nothing is said here about the cost of such a hatchery as is described, as the cost will vary in different localities, depending upon nearness to lumber supply, and price of labor, but with the general plan given in the plate, it will not be difficult to make an estimate of the probable cost when the location is selected. Such a hatchery could be adapted to other water supply than one coming in springs from the bottom, but usually springs are to be found by searching the shores of trout waters, and such a supply of water, with its even flow and temperature, is to be preferred to one coming from a stream liable to floods, discoloration and impurities.

About the only care such a hatchery requires is to rake over and scrub the gravel of the beds after the fry is removed, and this is done by forking it up at the sides while the water runs through it; for, while the gravel remains white and clean as long as the doors remain closed and it is dark inside, the sunlight causes green "mold" (*desmids*, representing a family of minute *Algæ*) to form on the gravel, which should be brushed off with a broom and dead eggs washed out at the same time. Such a hatchery will require but little of one man's attention for the most part, and the returns from it abundantly repay the outlay for construction. There is no way to count fry in such a hatchery until they are netted out to be placed in an outside rearing pond, but last spring I estimated that the hatchery in the illustration contained 60,000 or 70,000 strong, healthy fry, and it was believed that not many more than 300 trout were admitted to spawn in it last fall. The club desires to rear only a certain number of trout each year, to turn into the fishing pond something more than the number annually caught; but in a preserve, for instance in the Adirondacks, it would probably be desired that all the trout should be allowed to spawn under cover and so the hatchery would have

to be constructed to admit all that came to it at breeding time, and therefore the size of a hatchery to be erected would have to be based upon the number of trout likely to visit it. The hatchery that is 400 feet long will accommodate 500 or 600 breeding trout at one time (as a matter of fact Mr. Thompson tells me that one year he thinks not less than 1,000 spawning trout were admitted to the house, and they were mixed two and three year old fish, and with this number the gravel beds did not appear to be unduly crowded), and they should produce 125,000 to 175,000 fry if trout of all ages from wild waters are admitted, a sufficient number if the survivors are planted to keep up the stock in any preserve that I know of in this State, when the waters are fished only as preserved waters are ordinarily fished.

A. N. CHENEY,
State Fish Culturist.

REFLECTIONS ON TROUT WATER.

RED THROAT. BLACK SPOTTED OR ROCKY MOUNTAIN TROUT
(SALMO MYKISS. Walbaum.)

Fish Represented in Colored Plates.

Red Throat Trout.

ONE WAY.

TO describe the black spotted trout of the Rocky Mountains is very like an explorer entering a labyrinth with many windings and turnings, which, if followed, will lead the explorer, if he is an ordinary explorer, to but one conclusion—that he is lost, "hook, bob and sinker." The black spotted trout comes in series. There is the red throat trout (also called cut-throat trout, but that is not a pretty name) *Salmo mykiss*, without a single frill; the Columbia River trout, *Salmo mykiss clarkii;* the Yellowstone trout, *Salmo mykiss lewisi;* the *Salmo mykiss gibsii*, without a common name, as yet; the Lake Tahoe trout, *Salmo mykiss henshawi;* the Utah Lake trout, *Salmo mykiss virginalis;* the Rio Grande trout, *Salmo mykiss spilurus;* the Colorado River trout, *Salmo mykiss pleuriticus;* the Waha Lake trout, *Salmo mykiss stomias;* the Yellow finned trout, *Salmo mykiss macdonaldi;* and that is as far as the ichthyologists have got with *mykiss* up to this time, unless I have inadvertently skipped some.

But I have mentioned a sufficient number of varieties to show that the black spotted trout is a bewildering fish, taken together or in sections. My first acquaintance with one of these fishes, and I really do not know which one, for at the time I did not know there was so many of him, was made many years ago in Utah and Wyoming before they became States, and I then thought the fish I caught in Bear River and elsewhere was a very excellent fish on the hook and on the table, and altogether a well disposed and respectable black spotted trout. Since I have learned of the aliases under which the fish is known in different parts of the West, I have had my doubts.

The common names I have given will show how widely the *mykiss* is distributed in the waters of the West. As Jordan and Evermann say of it, "A very widely distributed species, found in all clear streams of the Rocky Mountains and Sierra Nevada, from Kamchatka and Alaska to Chihuahua and Northern California, and often entering the sea. It is exceedingly variable, being subject to many local changes, and its extreme forms show a degree of variation rarely met within the limits of a single species."

The excellent authorities I have quoted write of the black spotted, steelhead and rainbow, as the "American trout," and it would appear that they were the original pilgrims to our shores and waters, antedating the other and more noted pilgrims whose descendants now wage war against the earlier comers because of their game and toothsome qualities. They say: "It seems not improbable that the American trout originated in Asia, extended its range southward to the upper Columbia, thence to the Yellowstone and Missouri; from the Missouri southward to the Platte and the Arkansas, thence from the Platte to the Rio Grande and the Colorado, and from the Colorado across the Sierra Nevada to Kern River, thence southward and coastwise, the sea-running forms passing from stream to stream as far north as Fraser River where the variety *Kamloops* would mark one extreme of the series, and re-entering as a distinct species the waters long occupied by typical *mykiss*." All of which goes to prove that the American trout is a hustler and well named, and it does not make a bit of difference to the average angler whether his genealogy fits the branches of the family tree which the scientists have made for him or not; he is a good fish, a handsome fish and a game fish, even admitting that his pedigree is a little clouded. There may be an objection to an American trout being called *mykiss* because it is a vernacular name of the species in Kamchatka, but it must be remembered that the United States is not all of America, however much we may think so.

The typical black spotted trout, *Salmo mykiss*, has "body moderately elongate, compressed. Mouth moderate, the maxillary not reaching far beyond the eye. Vomerine teeth as usual, set in an irregular zigzag series; teeth on the hyoid normally present, but often obsolete, especially in old examples. Dorsal fin rather low; caudal fin slightly forked (more so in young individuals than in the adult, as in all trout). Back and caudal peduncle profusely covered with rounded black spots of varying size; dorsal, caudal and adipose fin covered with small spots about as large as the nostril; a few spots on the head; belly rarely spotted; inner edges of the mandibles below with a deep red blotch. * * * The red blotches on the lower jaw between the dentary bones on the membrane joining them is usually constant and characteristic." Some varieties certainly have no red mark under the jaw, and this is admitted by Gilbert and Evermann in their investigation of the Columbia River Basin,

STEELHEAD OR SALMON TROUT.

(SALMO GAIRDNERI, Richardson.)

for they say: "Thus the specimens from Wood River, Idaho, * * * have usually no red dash under the jaw. Some specimens show traces of the latter, and in such cases it is usually faint and irregular." It will be observed that the trout figured in the colored plate has but a dash of faint red under the jaw. The drawing was made from a fish reared at the Caledonia hatching station of this Commission, and I examined a number of individuals before selecting the one from which Mr. Denton made this drawing, and none had the red splash more pronounced than is represented. Commissioner Babcock, who has caught the fish in Snake River, tells me that in examples from that stream the splash is a deep blood red, and the fish is probably the variety known specifically as *S. mykiss lewisi*, in which the red throat mark is always present. Some varieties grow to great size, twenty to thirty pounds, but the ordinary maximum is about five or six pounds. In the West they spawn from May to the middle of July, and their eggs are heavy and non-adhesive like the native Eastern trout, and the same size, one-sixth of an inch in diameter. They are more prolific than the common brook trout, averaging from 1,000 to 6,000 eggs, which hatch in forty-five days, with a water temperature from fifty-two to sixty degrees.

At Caledonia station in this State (the only place, I believe, where the black spotted trout has been reared in the East) this fish begins to spawn before the middle of March and continues for two months. The impregnation of eggs is from ninety to ninety-five per cent., but just before the hatching period a large number of the eggs burst and the embryos are lost. There is loss, too, between the hatching and feeding times, and the fry do not feed as readily as the common brook trout; so that altogether Mr. Annin, the Superintendent of Hatcheries, estimates the total loss between impregnation of the eggs and feeding of the fry as about forty per cent. After the fry begin to feed, they are not more difficult to rear than the *fontinalis*.

The Steelhead.

This fish, called salmon trout on the Pacific Coast, is the only trout we have that is entitled to the prefix salmon, although the lake trout, *namaycush*, has been called salmon trout so long that it is most difficult for even the lawmakers to dispense with the name salmon and recognize a trout which never goes to salt water and is found only in deep, clear, cold-water lakes as a plain lake trout. The steelhead has been introduced into the waters of New York since the red throat trout, to which with the rainbow it seems to be related more or less closely. In the State ponds it is sometimes a problem to separate the steelhead from the red throat or rainbow, by looking at them as they are dipped out in a net, for at certain seasons there is a strong family resemblance.

16

Of this fish, Capt. William E. Dougherty, United States Army, in charge of the United States hatching station at Hoopa Valley, California, wrote me in May, 1896:

I am not able to give you an authentic instance in which it can be shown that the steelhead has spawned and reared young in fresh water without going to the ocean first. But it must be remembered that very little scientific inquiry has been made into the habits of the steelhead, or indeed of the salmon on this coast. I have some steelheads in our ponds here, now three years old. We examined them about two weeks ago and found roe in the female and milt in the male, but so microscopic as to be almost rudimentary. It is quite possible that these fish may spawn next year.

It has been alleged that the rainbow trout is a fresh water modification of the steelhead. Recent investigation, however, supplies evidence that the two fish are different, and this has been confirmed somewhat by an experience here. It is alleged that the Kamloops trout of Washington is an off-shoot of the steelhead. The Kamloops trout is land-locked and never gets to the ocean; and so if it is a steelhead, it goes to show that the steelhead will spawn without going to sea. But, again, it must be said that as little is known of the Kamloops as of the steelhead proper. My own opinion is that, if the steelhead will adapt himself to a fresh water habitat, it will spawn and rear young in it without going back to salt water. It should be borne in mind that the natural range of the steelhead in the ocean on this coast is in water that never has any ice in it, and they do not enter the streams in the spring in any considerable numbers until the temperature of the water begins to rise.

Since Capt. Dougherty's letter was written, United States Fish Commissioner Bowers has informed me that the steelhead has matured in the ponds of the hatching station at East Orland, Maine, and eggs have been taken. These fish were reared in fresh water ponds at the station. Steelhead eggs bear transportation remarkably well, which has not always been the case with the red throat trout. Some steelhead eggs were sent from Capt. Dougherty's station in California to Mr. S. Jaffé, the well known fish culturist in Osnabrück, Germany, who wrote me that out of 10,000 eggs, there was a loss of only 720 in transit and hatching, and the fry were vigorous and promised well.

The Fisheries, Game and Forest Commission, through the courtesy of the United States Fish Commission, obtained a quantity of steelhead fingerlings and some were planted in a Long Island stream and some in a Northern New York lake. Those that were planted on Long Island, when rather more than a year old, rose to the fly of the trout fisherman and made a most gallant fight, but at this time it is too early to tell what the outcome of the plantings will be. That they are a game fish there is not the least doubt, as has been demonstrated at the rearing ponds.

The steelhead enters the Columbia river in the fall (this I say on the authority of the United States Fish Commission, although it is contrary to what Capt. Dougherty's letter would lead one to suppose from his own experience with the fish) and spawns the following spring from February to May. The eggs are larger than the red throat eggs, being one-fifth of an inch in diameter, and average from 3,000 to 5,000 eggs per

GOLDEN SHINER OR BREAM.

(ABRAMIS CRYSOLEUCAS. Mitchill.)

fish and hatch in from forty-two to fifty days with water at fifty degrees. The character of the egg is like the red throat and *fontinalis*, heavy and non-adhesive. A scientific description of the steelhead is not necessary at this time, but I give the coloring from Jordan and Evermann:

Color, olive green above; sides, silvery; head, back, upper fins and tail, more or less densely covered with black spots; belly usually unspotted; males with colors heightened, the back greenish; both sexes in spring with a broad flesh colored lateral band, deep, rosy red on the opercles, this often retained throughout the year; fins not red; no red on the membrane of the lower jaw.

In the Kamloops, or lake form of the steelhead, the lateral band is a bright rose pink. Jordan and Evermann say, as a sort of summary of the *mykiss*, steelhead and rainbow:

It is not unlikely that, when the waters of the Northern hemisphere are fully explored, it will be found that all the black spotted trout of America, Europe and Asia are forms of one species, for which the oldest name is *Salmo trutta*, Linnatus.

Salmo trutta is the sea trout or salmon trout of Europe, and I was instrumental in bringing the first of them to this country, and the State of New York has planted some under the name of Scotch sea trout, and I hope it has not made trouble for future ichthyologists.

Golden Shiner, or Bream.

Really that title should be reversed, for the fish is a bream, and is called golden shiner, by which name it is better known than as bream or roach which is still another common name for it.

The introduction of this fish in a colored plate is a tribute to the fisherman, for it is a bait fish pure and simple and not a food fish in this State, although it grows under favorable circumstances to twelve inches in length.

The golden shiner is the most expensive fish that I have ever bought, living or dead, for on an occasion I have paid as high as 25 cents per ounce for it, and got two shiners for one dollar. That particular season gold shiners were scarce and were caught with hook and line to be used as bait in trolling for lake trout. They are very delicate, the scales coming off very easily when the fish is handled, and in the spring they are apt to be scarce during high water when lake trout trolling is best and they command a good price, so that the fishermen usually sew them to the hooks on which they are impaled. Their bright color makes them a shining mark in clear water, and they can be seen a long distance by the fish which they lure to the angler's gaff. In the summer they are used as bait for black bass, but are not considered as good as

other of the *Cyprinidæ* used for bass bait. Scientifically they are described: "Body moderately elongate, strongly compressed. Head short * * the profile somewhat concave. Mouth small, oblique, the upper lip on line with upper part of pupil, the maxillary not reaching front of eye. Color clear, greenish above; sides silvery, with bright golden reflections; fins yellowish, the tips of the lower fins sometimes slightly orange in spring males." The fish is a spring spawner, like all the carps, and is found in weedy streams and ponds.

White Bass.

This fish, also called white lake bass, is an excellent pan fish as the flesh is very like that of the black bass and similarly well flavored. It is a deep or still-water fish, rarely ascending small streams. It is a game fish for one of its size, growing to a maximum of fifteen inches. It is found in the lakes of Western and Central New York and has been introduced into the waters of some of the Eastern States as an addition to the supply of food fishes. This fish is sometimes confounded with the yellow bass of the same genus but of a different species, and may be distinguished by the fact that the two dorsal fins are entirely separated, the two dorsals of the yellow bass being connected with a low membrane.

"Body rather deep and compressed, the depth more than one third the length; back considerably arched; mouth moderate, nearly horizontal, the lower jaw little projecting; eye large, nearly as long as snout; maxillary reaching middle of pupil * * head scaled to between nostril; * * color silvery, tinged with golden below; sides with narrow dusky lines, about five above lateral line, one along it, and a variable number below it, then sometimes more or less interrupted or transposed. Not found in salt water; generally abundant in Great Lakes."

Fall Fish or Silver Chub.

This is the largest of the *Cyprinidæ* or carps, of which we have about 1,000 species in the old world and the new, and is known also as wind fish, cousin-trout and corporal. When Dr. Theodatus Garlick, the father of fish culture in America, made known the fact that he had hatched trout artificially in 1854, a claimant appeared to wrest from him the honor of being the first in this country to hatch fish by artificial means. This was Rev. John Bachman, who claimed to have hatched fish in 1804. Curiously enough Mr. Bachman claimed, in a paper read before the State Agricultural Society of South Carolina, in 1855, a year after Garlick hatched the eggs of trout in Ohio, that his first experiment in 1804 was in hatching the eggs of the corporal, and

ALEWIFE OR BRANCH HERRING.

(POMOLOBUS PSEUDOHARENGUS.)

the parent fish had been dead several hours when he took the eggs which he subsequently hatched. He claimed next to have hatched the eggs of yellow perch after drying them for ten days. It was the printed details of these experiments which caused the late Spencer F. Baird to write to Dr. Garlick as follows:

> I had never attached so much importance to the statements of Dr. Bachman as Mr. Milner did, and I am quite satisfied that there were serious errors in Dr. Bachman's statements; so great, indeed, that whatever may have been the actual facts, they could not have been as given by him. In any event, anything Dr. Bachman may have done cannot affect your position as the first person to actually propagate fish in the United States by artificial methods.

The fall fish is called cousin trout in New England in allusion to its troutlike habits. Many is the time that one of these fish has risen to my flies when fishing a trout stream, missing over and over, until from its rising short repeatedly, which appears to be characteristic of the fish, I have discovered that it was a chub and not a trout. It grows to four or five pounds in weight and affords fair sport with fine tackle. One authority says it is esteemed as food, but Thoreau said "The chub is a soft fish and tastes like brown paper, salted." A lady of my acquaintance, when I visited her husband for fishing in a cold New England lake, always requested that the fall fish be saved for her, and I confess that when taken from that cold, clear water and cooked, the fall fish was not to be compared to brown paper, salted; for, except that the flesh is rather sweet, it is equal to some other fishes that I know are esteemed as food.

There is another and smaller chub belonging to the same genus called horned dace or creek chub, which has a conspicuous dark spot at the base and front of the dorsal fin by which it can always be separated from the fall fish. Small fall fish, with their glittering silver scales, make an excellent bait for other fish Under the drawing of the fall fish, I have used the specific name *Semotilus bullaris* (Jordan and Gilbert), and not *S. corporalis* which is a later classification by Jordan and Evermann. For this I think I have sufficient warrant without an extended explanation of why I did it, as the explanation will be made elsewhere and by another pen than mine.

Alewife or Branch Herring.

This fish illustrates the fondness of our people for applying several common names to one of our fishes when it is found in different waters, as it is known, in addition to the two names given above, as gaspereau, wall-eyed herring, big-eyed herring, ellwife and sawbelly. It is abundant along the Atlantic Coast, entering the streams to spawn, and also found in the interior lakes of this State, where it is known scientifically as variety *lacustris*. The name sawbelly is given to it in Lake Ontario and the St. Lawrence, and, I think, also in Cayuga Lake, where it swarms and where great

multitudes die every year in early summer. From the best information obtainable the fish die from a change in the temperature of the water. Coming from the deep cold water at the bottom into the warm surface water, heated by the summer's sun, they make a spasmodic movement, turn over and die in such quantities that the surface of the water is covered with them, and it is sometimes a problem to get rid of their decayed and decaying bodies. In Cayuga Lake they are found in very deep water, but when drawn to the surface, succumb with a motion of their bodies which fishermen call a "fit." They furnish an abundance of food for certain fishes, and are an excellent bait, but are not regarded as food for mankind when taken in the interior lakes. In color it is "bluish above; sides silvery; indistinct dark stripes along the row of scales; a blackish spot behind opercle."

Common Whitefish.

Of nine species of whitefish in this country the common whitefish or Great Lakes whitefish is the best known and most highly valued as a food fish. It is one of the most delicate of table fishes, as it feeds on minute organisms, and a form of this fish found in Otsego Lake, and there called Otsego bass, is as highly prized as any food fish which swims in our waters. In fact, there has always been a halo about the "Otsego bass" as a superior food for "Gods and honest fisher folk" that time and distance will not dispel. If, however, there is a more delicate and delicious fish than the whitefish from Hemlock and Canandaigua Lakes, where this Commission propagate the species, I think an epicure would give good money of the Republic to know where the fish is to be found. Fresh from the water, the flesh of the fish is white, firm, rich and with a delicate flavor all its own. But, to be at its best, the fish must be eaten near the place where it is taken when the water is cold.

When the Fisheries, Game and Forest Commission began to propagate whitefish at Canandaigua, and later at Hemlock Lake, it was believed that the fish was Richardson's whitefish, *Coregonus labradoricus*, and it was referred to in papers and correspondence of the Commission as the Labrador whitefish, but a more careful examination of specimens by Dr. Bean led him to believe there was some mystery about the classification of the whitefishes and he made a study of the whole question and published the result of his conclusions in "Science," which is here reproduced:

IDENTITY OF COMMON AND LABRADOR WHITEFISH.

The common whitefish of the Great Lakes was first very imperfectly described by Dr. Samuel L. Mitchill, in *The American Monthly Magazine and Critical Review*, for March, 1818. The description, in fact, is so unsatisfactory that his contemporaries and later ichthyologists for more than fifty years supposed it to refer to the cisco, or lake herring, *Argyrosomus artedi.*

COMMON WHITEFISH MALE FROM CANANDAIGUA LAKE.

(COREGONUS CLUPEIFORMIS. Mitchill.)

A good account of the whitefish was published by Richardson, in 1836, under Le Sueur's name of *Coregonus albus*, a name published only a few weeks later than that of Mitchill; but, like Mitchill's, unaccompanied by a sufficient description.

In 1836 Richardson established a new species of *Coregonus* upon a dried specimen which he received from Musquaw River, that falls into the Gulf of St. Lawrence, near the Mingan Islands, giving it the name *Salmo* (*Coregonus*) *labradoricus*. This has been retained in the literature as a distinct species up to the present time, although its close relationship to the common whitefish has sometimes been observed without recorded comment.

Systematic ichthyologists have found it difficult to show clearly the differences between the common whitefish and the Labrador whitefish, as may be seen by referring to the monographs upon the whitefishes by Jordan and Gilbert, Bean and Evermann and Smith. They have been forced to rely, finally, upon a single character, the presence of several rows of teeth on the tongue to distinguish the two forms, and this was supposed to be constant and infallible.

The writer has recently had occasion, while studying the fishes of the State of New York, to examine numerous specimens of the common whitefish from the Great Lakes and interior lakes of New York and of the so-called Labrador whitefish from lakes of New York and New Hampshire and from rivers in New Brunswick and Labrador. As a result of these investigations he is forced to the conclusion that Richardson's species, *Coregonus labradoricus*, is identical with the common whitefish, *Coregonus clupeiformis*, there being no characters by which the two can be distinguished. Every individual of the common whitefish, young and old, was found to have teeth on the tongue and to possess the other characters by which Richardson's species has hitherto been separated.

This conclusion has an important bearing upon fish-cultural operations by the States and the United States, as it will tend to simplify the work of artificial propagation and, perhaps, extend its scope.

WASHINGTON, D. C. TARLETON H. BEAN.

The drawings of the whitefish were held up until after a considerable correspondence with Dr. Bean, and on the publication of his conclusions it was decided to drop the name Labrador in connection with whitefish from this and future reports of the Commission.

In explanation of the apparent difference between the two whitefishes represented in the colored figures the fish from Hemlock Lake and used as a model by the artist was a female weighing eleven and one-quarter pounds, and the Canandaigua fish was a male of about three and one-half pounds.

Hemlock Lake was stocked with whitefish from fry hatched at Caledonia station and planted by the State, and there can be no better illustration of the value of the work of a State Fish Commission than the results obtained in this instance. The first plant was made December 20, 1870, and the next in 1871, and from these two plantings the present fine stock of fish in the lake has resulted. The eggs of the whitefish hatched at Caledonia were procured from Detroit. It is doubtful if any water to-day furnishes so many large whitefish for the number taken as Hemlock Lake. Specimens weighing over twelve pounds have been caught; and, when the men are

netting the lake to obtain eggs, a large proportion of the fish weigh from six to ten pounds each. The work of hatching whitefish from eggs obtained in the interior waters of the State is now in its infancy, with every prospect of growing to far larger proportions then when the State was dependent upon the Great Lakes for whitefish ova. Conditions, over which man has no control, are always arising, which prevent pike-perch from running into the streams where they may be taken for spawning purposes, and smelt running in from the sea to fresh water streams for the same purpose, and shad, too, fail on occasions to come up the river past the nets which almost fence in the river and fence out the migratory fish, but the whitefish promise to furnish an abundant supply of eggs annually to keep up the supply of this fish in State waters and possibly to supply new waters with this choice food fish. Whitefish spawn in November and December, and average 35,000 eggs per fish. The eggs are semi-bouyant, non-adhesive and one-eighth of an inch in diameter. In water that is thirty-four degrees, they hatch in 150 days.

The whitefish is not taken with hook and line and so I do not add a description of it, as the colored drawings will serve the purpose of printed words.

A. N. CHENEY,
State Fish Culturist.

"NOT ALL'S FISH THAT COMETH TO NET."

Oyster Bed Leases and Franchises.

WITHOUT attempting to go into the merits of past legislation in regard to franchises and leases of oyster beds under the jurisdiction of the State it may be stated briefly that chapter 584 of the Laws of 1887 provided for perpetual franchises for shellfish cultivation and that chapter 321 of the Laws of 1893 repealed the franchise law and provided for leases of oyster beds for a term of fifteen years. While this report was in course of preparation another law was passed, chapter 458, Laws of 1898, which provides for perpetual franchises for shellfish cultivation in Long Island Sound in Suffolk county.

In consequence of this legislation oyster beds in the State waters are now held by franchise and by lease and a complete alphabetical list of both is given herewith, as shown by the books of the Shellfish Department, October 1, 1898. Laws now in force relating to shellfish cultivation may be found in article 8, sections 180 to 199 of the Fisheries, Game and Forest Laws.

Leases.

	ACRES.
Abrams, W. H.,	3.
Abrams, Elmer E.,	6.
Abrams, John,	6.6
Abrams, Major G.,	13.
Ackerly, W. S.,	16.2
Beebe Brothers,	60.
Boehmcke, Henry,	19.4
Behncke, H. W.,	2.6
Behncke, Mary,	5.8
Borwegan, Henry,	4.4
Bogart, John H.,	4.2
Biggs, Edward,	.6
Biggs, Jr., John,	7.2
Biggs, C. Josephine,	1.6
Biggs, Richard,	11.9
Biggs, George,	2.4
Butecke, H. M.,	2.2
Baldwin, Charles V.,	6.5
Baldwin, William C.,	5.4
Bush, Peter,	1.2
Burmester, Henry,	6.2
Boegel, Frederick,	9.2
Bailey, Margaret E.,	6.4
Carman, George L.,	5.2
Carman, Estella,	4.2
Carman, Nicholas D.,	5.2
Carman, George A.,	13.8
Carman, Nathaniel,	3.
Carman, Albert M.,	2.
Cole, Dexter K.,	220.
Decker, David,	8.6
De Waters, Philip,	18.2
Davis, Nathaniel E.,	3.2
Davis, James V.,	.6
Davis, L. V.,	3.
Davis, W. C.,	11.8
Davis, Jr., L. V.,	11.8
Davis, Alice A.,	12.6
Dickens, James,	4.8
Dickens, Annie,	5.
Dickens, William H.,	2 8
Drange, Rudolph,	2.4

	ACRES.
Denton, Walter C.,	1.
Denton, Charles E.,	5.4
Davenport, John,	9.8
Davenport, Annie,	3.2
Denice, John R.,	11.
Depuy, Austin,	5.2
Enniss, Josephine C.,	3.8
Enniss, Martha W.,	9.4
Enniss, J. C.,	11.4
Eberhardt, George,	.8
Eldert, Samuel,	5.
Eckert, Charles, and A. M. Morrison,	19.
Ford, W. S.,	4.4
Ford, John T.,	12.2
Fehnemann, Henry,	2.4
Fortmeyer, William,	3.
Flaherty, Joseph,	5.4
Geffken, Albert,	2.4
Geffken, Josephine,	8.
Gunnion, Samuel,	3.4
Grimm, John,	5.
Godfrey, Joseph R.,	4.2
Gustafsen Gottfrid,	3.6
Houghwont, W. H.,	4.2
Hayward, Joseph W.,	3.
Hodgson, W. F.	5.8
Howarth, James,	17.8
Harris, Joseph,	6.8
Hansen, John,	15.6
Huffmire, Daniel F.,	1.6
Huffmire, Lawrence L.,	19.2
Hale, W. A.,	9.2
Jones, David,	3.8
Johnson, Nettie,	27.2
Johnson, Lydia A.,	4.
Johnson, Dower J.,	5.
Johnson, Iva,	3.8
Johnson, Richard,	5.
Johnson, George H.,	7.4
Johnson, Mary,	3.
Johnson, John J.,	19.4
Johnson, Jane,	5.
Johnson, Charles L.,	2.4
Johnson, William C.,	15.2
Johnson, Adeline,	1.4
Joline, A. S.,	3.

	ACRES.
Krier, Henry,	5.2
Klee, Ludwig,	4.6
Kopf, Claus,	41.6
Kind, Robert,	3.8
Lackert, Gerhart,	7.
Lundy, Rosa C.,	3.4
Lundy, Walter,	1.6
Lundy, Athenaise,	1.6
Lundy, Frederick,	10.4
Lundy, John,	7.2
Lundy, Jerome,	4.8
McCrodden, James H.,	4.
McCrodden, Clara,	2.6
McCrodden, Charles,	9.4
McCreddon, Joseph,	13.6
McCreddon, Isaphine,	12.6
McCreddon, Charles,	5.
McCreddon, Robert,	1.8
McCreddon, Albert,	3.8
McCreddon, Jr., Joseph,	6.
McNamara, Stephen N.,	2.
Miller, Peter,	3.8
Miller, Margaret,	3.2
Miller, Philip,	3.8
Moller, Ferdinand,	8.8
Morrison, W. I.,	6.4
Morrison, Edward,	5.2
Morrison, James H.,	6.
Morrison, W. H.,	5.6
Morrison, Benjamin B.,	9.2
Morrison, Martin,	1.6
Morrison, John A.,	6.8
Morrison, Henry,	8.8
Matinicock Oyster Co.,	386.6
Matthews, William,	.6
Matthews, Isaac J.,	5.
Matthews, Jr., John J.,	3.8
Moore, Christopher,	3.
Moore, Alfred,	7.4
Newbury, George,	6.8
Nelson, Charles,	10.2
Northport Oyster Co.,	480.
Oelrichs, William,	5.8
Oelrichs, Annie,	5.2
Pelletier, Napoleon,	5.2
Powell, James T.,	6.6

	ACRES.
Powell, George H.,	6.2
Peers, Carl,	10.
Peterson, Alexander,	20.2
Price, Albert, John and David,	8.
Quigley, John,	3.6
Rowland, Katie A.,	4.4
Rowland, Daniel,	6.5
Rowland, Edwin L.,	4.2
Redfern, John,	4.
Ryder, Benjamin,	8.4
Ryder, Grace L.,	.8
Ryder, James J.,	4.8
Raynor, William,	7.6
Robinson, G. W., and others,	3.
Schmeelk, John H.,	33.8
Schmeelk, William M.,	12.2
Schmeelk, Henry L.,	4.2
Schmeelk, Harry W.,	13.4
Schmeelk, Hattie A.,	3.
Schmeelk, Jennie L.,	3.4
Schmeelk, George,	4.8
Schmeelk, Harry N.,	4.8
Schmeelk, Fannie A.,	5.2
Schmeelk, Jr., Harry W.,	8.8
Schmeelk, Peter N.,	16.2
Schmeelk, Herman M.,	42.6
Shafer, Nikolaus,	1.8
Sofield, Julia,	31.4
Sofield, Charles,	3.2
Stillwell, Charles,	4.
Stillwell, Jr., Charles,	2.4
Seaman, Erastus W.,	3.6
Seaman, Charles H.,	7.8

	ACRES.
Schriefer, G. Andrew,	3.2
Schlatenberg, Henry,	3.2
Schumacher, John H.,	6.
Schumacher Henry,	9.2
Skidmore, John R.,	2.6
Skidmore, Isaac H.,	2.2
Sanbeg, George W.,	4.4
Thorn, Samuel,	119.6
Tillotson, W. J.,	11.6
Tillotson, Margaret,	4.2
Tromer, W. S.,	12.
Van Name, Frederick,	13.5
Van Name & J. I. Housman,	6.3
Von Twistern, Heinrich,	4.2
Van Ahnen, William,	10.6
Van Ahnen, Annie,	4.8
Van Ahnen, A. H.,	8.2
Van Ahnen, Herman,	6.4
Vreeland, John H.,	12.
Vreeland, Cornelius,	6.2
Vreeland, Johanna,	1.8
Vooris, Charles L.,	11.
Vaught, John W.,	3.2
Wight, John F.,	6.8
Whittaker, L. I.,	5.
Whittaker, John,	16.2
Warner, William J.,	34.2
Warner, William,	7.8
White, Victor,	4.4
Winterberg, T. F.,	2.4
Wofield, John R.,	8.2
Total,	2,666.1

Franchises.

	ACRES.
Ackerly, Mary M.,	308.9
Ackerly, H. Davis,	172.2
Ackerly, N. S.,	220.
Ackerly, Andrew,	117.5
Ackerly, S. Leroy,	216.8
Abrams, H. B.,	7.5
Androvette, George T.,	42.7
Androvette, A. W.,	2.4
Androvette, John E.,	7.3
Androvette, Winant S.,	32.2
Androvette, W. & J. M.,	18.7
Androvette, Abram M.,	9.2
Androvette, John,	30.3
Androvette, John O.,	5.1
Bowlby, F. H.,	65.
Bartow, O. & M. G.,	17.5
Bayard, Annie,	5.7
Bennett, W. J.,	250.
Bedell, Mrs. E. A.,	30.1
Bedell, Israel,	51.7
Bedell, Adeline,	7.8
Bedell, Charles,	3.3
Bell, Alexander,	83.1
Brush, Egbert,	118.2
Bryant, Ebenezer,	193.6
Brown, F. W.,	4.3
Brown, W. A.,	3.2
Bradish, George,	17.3
Bishop, Roscoe,	38.7
Bishop, George and Josiah,	3.1
Bishop, Eben. and Josiah,	3.
Burbank, Jr., S. D.,	18.2
Burbank, Daniel,	117.9
Burbank, J. H.,	29.8
Butler, Daniel,	1.85
Butler, N. L.,	36.7
Butler & Drake,	9.9
Bush, John P.,	6.
Bush, William,	60.1
Bumstead, Jacob,	18.
Boerum, F. T.,	2.5
Buchanan, William,	2.5
Cannon & Decker,	21.9
Cannon, Alfred,	.8

	ACRES.
Cannon, Andrew,	2.9
Call, Charles W.,	46.3
Call, George E.,	74.9
Chick, A.,	7.5
Conant, F. K.,	12.5
Cooley, William,	5.3
Cortes, Frederick S.,	150.
Colon & Crocheron,	7.5
Colon, D. B.,	43.5
Colon, Thomas,	26.5
Colon, Sarah E.,	42.8
Cole, Edward,	.6
Cole, J. W.,	12.
Cole, Dexter K.,	161.
Cornell, C. W.,	7.
Crocheron, George W.,	26.4
Darling, Jeremiah,	98.
Darling, A. M.,	78.7
Davis, Lewis S.,	110.4
Davis, Frederick,	8.8
Davis, Henry,	8.8
Decker, Howard,	1.3
Decker, David L.,	5.6
Decker, C. V. N.,	64.5
Decker, Oscar L.,	1.7
Decker, Elmer,	54.
Decker, David D.,	7.
Decker, Sherman,	38.
Decker, Daniel,	31.2
Decker, David,	30.6
Decker, Charles,	1.2
Decker & Burbank,	4.5
Depuy, Croel,	5.9
Depew, R.,	3.8
Depew, Austin,	.2
De Hart, Mathias,	3.3
De Hart, Theodore, and Samuel,	92.
De Hart, Henry,	88.4
De Hart, Smith W.,	4.5
De Hart & Housman,	1.3
De Waters, Philip,	41.2
Delfyette, J. H.,	7.5
Drake, C. M.,	5.1
Dickerson, Jacob M.,	171.2

	ACRES.
Du Bois, Alfred,	13.6
Du Bois, R. C.,	6.2
Dissosway, Cornelius,	2.7
Davis, Elbert M.,	104.
Ellis, C. C. (Administrator of David Joline),	20.6
Ellsworth, Philip,	5.4
Ellsworth, J., & J. W.,	124.
Edwards, Jacob,	25.1
Everson & Forrester,	2.6
Englehecht, Mrs. J. W. C.,	10.7
Felch, W. H.,	3.7
Fisher, James,	13.9
Forrester & Hoag,	35.3
Forrester, George E.,	8.4
Forrester & La Forge,	2.9
Fowler, T. W.,	5.
Fowler, C.,	5.
Frost, Samuel,	8.8
Frazer, Alexander,	1.3
Frazer, John,	62.5
Furman, W. H.,	190.8
Gaynor, William J.,	250.
Green, Clarence S.,	45.6
Grant, William,	10.2
Halsey, Stephen L.,	106.6
Hallock, G. W.,	106.4
Hallock, A. E.,	108.9
Hall, Elnathan,	8.8
Hall & Grant,	19.
Hall, A.,	25.5
Halle, Eugene B.,	17.8
Halle, William W.,	7.4
Henman, John H.,	1.3
Henry, Franklin,	1.8
Housman, Jacob I.,	281.3
Housman & Van Name,	.5
Housman, Nicholas P.,	240.
Housman, Mary E.,	240.
Houghwont, W. H.,	52.9
Hopping, Samuel L.,	6.8
Hoag, John S.,	10.3
Holbert, Thomas W.,	11.6
Jacklin, George,	10.
Jacklin, Nelson,	4.4
Jackson, Charles,	.4

	ACRES.
Jennings, Gould J.,	2.4
Jones, Walter,	173.2
Jones Sons, C. C.,	172.2
Jones, George,	10.1
Jones & Burbank,	77.3
Jobes, Thomas L.,	23.9
Johnson, Dower J.,	.5
Johnson, David,	8.6
Johnston B.,	2.5
Journeay, J. W.,	3.8
Journeay, Henderson,	4.2
Joline, W.,	10.5
Joline, A. S.,	84.5
Joline, D.,	87.5
Joline, D. A.,	10.5
Joline, Frank,	4.1
Joline, Seth C.,	10.3
Joline, S. C. & D. A.,	54.5
Joline, Heirs B.,	3.
Joline Brothers,	4.1
Joline, T. W.,	30.6
Kaiser, Joseph B.,	10.8
Kane, Edward,	67.8
Kingsland, Westley,	10.9
Knight, J. L.,	187.5
Latourette, Sr., Paul,	12.
Latourette, Abram,	13.
Landin, Dawson,	37.3
Landin, Robert,	15.3
La Forge, John E.,	9.8
La Forge, W. W.,	24.2
La Forge, N.,	2.6
La Forge, Richard,	5.7
La Forge, Israel,	3.7
La Forge & Latourette,	16.6
La Forge, Henrietta,	2.2
La Forge, Nicholas,	.8
Lewis, H. H.,	124.6
Lewis, J. F.,	87.5
Lewis, J. B.,	15.
Manee, Abraham and William,	32.3
Manee, Elias P.,	64.2
Manee, W. N.,	38.5
Manee, Wilbur N.,	11.1
Manee, J. J.,	13.3
Manee, Sr., William,	13.6

	ACRES.
Manee, George A.,	1.9
Manee, Abram,	15.8
Martineau, Abram,	76.7
Martin, Abel,	4.1
Marshall, George,	19.1
Marshall, John,	27.2
Marshall, James M.,	4.9
Marshall, Henry S.,	3.8
Merritt, John E.,	101.3
Merritt, Daniel,	146.4
Merserole, Robert C.,	8.8
Mercereau, I. P.,	26.6
Mercereau, Augustus,	.5
Mercereau, J. J.,	3.4
Merrell, Azel F.,	133.7
Merrell, John I.,	98.7
Merrell, M. T.,	22.3
Merrell, Thomas S.,	70.8
Merrell & Post,	12.3
Merrell & Son, William,	36.3
Merrell, G. W. H.,	42.8
Merrell, Thomas J.,	16.2
Merrell, John E.,	9.6
Merrell Brothers,	.6
Merrell, John D.,	1.8
McDonald, Peter,	126.5
Miller, Peter,	11.8
Miller, Eliza A.,	63.5
Miles, Rowland,	197.8
Monsell, Hiram,	250.
Morton, T. L. & W. A.,	213.2
Morse & Krone,	.6
Moore, Alfred,	5.3
Noe, James E.,	.9
Noe & Son, David O.,	7.3
Newbury, George,	9.5
Northport Oyster Co.,	1,392.5
Page, J. L.,	24.4
Palmer, H. F.,	249.
Palmer, Alfred,	2.6
Palmer, Chas. E., C. F. & Clarence E.,	375.
Pernell, George,	1.4
Pedersen, Nils,	16.8
Platt, Elias S.,	79.4
Post, Garrett,	28.7
Post, E. M.,	29.7
Post Bros.,	50.9
Post, William,	64.1
Post, John H.,	210.
Poillon, J. S.,	1.3
Polworth & Ellsworth,	125.4
Price, Crowell,	7.9
Price & Merrell,	4.6
Price, Joseph,	6.9
Price, Benjamin C.,	3.4
Price, David,	8.3
Price, Elmer,	26.
Price, C. B.,	3.2
Price, John H.,	3.1
Pratt, F. J.	6.1
Primrose, James,	106.1
Randall, Charles P.,	104.
Reed, Isaac J.,	4.8
Reddy, E. J.,	14.
Risley, William,	99.2
Rowe, W. H.,	64.8
Rowley, E. N., and Scudder Smith,	77.
Roe, E. V.,	2.5
Roe, L. F.,	2.5
Scudder & Knight,	115.1
Scudder, David E.,	120.
Scott, Daniel,	21.9
Schenck, P. E.,	83.1
Sharrot, A. W.,	52.4
Silk, Thomas,	15.8
Simonson, David,	8.7
Simonson, J. and B. K.,	1.4
Simonson, Cornelius,	1.
Simonson, B. K.,	1.8
Simonson, O. D.,	3.4
Simonson, Jacob,	4.5
Sleight, John W.,	1.2
Sleight, John S.,	17.1
Sleight, John M.,	24.1
Sleight, C. W., and G. H.,	4.4
Sleight & Manee,	10.5
Skidmore, Floyd,	30.
Skidmore, David,	1.8
Smith, Daniel S.,	173.6
Smith, G. H.,	5.
Smith, Col. D.,	107.8
Smith, W. G.,	109.5

	ACRES.
Smith, G. A.,	110.2
Smith, James Clinch,	113.2
Smith, H. J.,	213.2
Smith, Edmund N.,	224.2
Smith, W. W.,	26.9
Smith, T. M.,	2.5
Smith, C. A.,	2.5
Smith & Wilson,	24.6
Southard, William,	17.6
Southard, J. A.,	17.6
Sofield, A. C.,	1.5
Sprague, Albert,	1.8
Sprague, S. B.,	5.2
Sprague & Mercereau,	17.5
Sprague, J. M. & Edward,	13.6
Sprague, F. T.,	8.3
Sprague, Charles B.,	15.3
Sprague, J. W. J. and J. H.,	14.2
Stevens, W. N.,	5.
Steinsieck, C. H. G.,	250.
Steinmire & Fisher,	14.6
Storer, Thomas,	.9
Storer & Kingsland,	2.6
Thompson, S. M.,	249.6
Thompson, John,	16.6
Thompson, Westley,	10.4
Thompson, George F.,	14.4
Titus, Irving,	140.
Tormey, Lawrence,	250.
Tomlinson, J. R.,	69.
Townsend, W. E.,	28.2
Totten, Alvin A.,	2.6
Tyler, J. J.,	115.7
Tyler, Emma J., and Albert Darling (as trustees),	74.8
Tyler, J. M.,	75.6
Tyler, J. M. & J. I.,	74.5
Tyler, Benjamin and Edward,	58.9
Tyler, Charles,	47.3
Tyler, Benjamin,	73.2
Tyler, Mary A.,	76.2
Underhill, Kirk,	75.3
Van Name, Henry,	5.6
Van Name, M. & P. M.,	58.5
Van Name Brothers,	180.9
Van Name, David,	100.4
Van Name, Catherine,	5.4
Vanhorn, D. L.,	250.
Valentine, Charles,	8.8
Valentine, Stephen,	8.8
Van Wart, C. L.	27.5
Van Wyck, J. M.,	62.1
Van Pelt, F.,	12.3
Van Pelt, William,	.4
Van Wagener, H. S.,	6.1
Vandervort & Swain,	7.7
Velson, Daniel,	235.2
Verity Brothers,	173.5
Vreeland, J. H.,	225.
Vreeland, C. P.,	87.5
Vroom, Joseph,	120.
Walters, Samuel A.,	260.
Walters & Wright,	11.8
Wagner, Frederick,	3.5
Weir, W. W.,	39.3
Weaver, J. A.,	25.2
White, James,	5.
Winant, J. C.,	.8
Winant, J. B. C.,	8.9
Wicks, F. A.,	67.2
Wood, J. S.,	90.
Wood, J. N.,	8.4
Wood & Co., David,	4.4
Wood, Edmund,	3.1
Wood, J. A.,	3.2
Wood, A. J.,	13.2
Woglan, A. W.,	3.6
Wright, John,	45.1
Wright & Sons, G. P.,	52.9
Ziegler, Mrs. Charles,	7.4
Total,	18,366.5

The Wood-duck *(Aix sponsa)*.

By WILMOT TOWNSEND.

Male.

"THE wood-duck is nineteen inches in length and two feet four inches in extent; bill red, margined with black; a spot of black lies between the nostrils, reaching nearly to the tip, which is also of the same color, and furnished with a large hooked nail; irides orange red; front, crown and pendent crest rich glossy bronze green ending in violet, elegantly marked with a line of pure white running from the upper mandible over the eye, and with another band of white proceeding from behind the eye, both mingling their long pendent plumes with the green and violet ones, producing a rich effect; cheeks and sides of the upper neck violet; chin, throat and collar round the neck pure white, curving up in the form of a crescent nearly to the posterior part of the eye; the white collar is bounded below with black; breast dark violet brown, marked on the fore part with minute triangular spots of white, increasing in size until they spread into the white of the belly; each side of the breast is bounded by a large crescent of white, and that again by a broader one of deep black; sides under wings thickly and beautifully marked with fine undulating parallel lines of black, on a ground of yellowish drab; the flanks are ornamented with broad alternate semi-circular bands of black and white; sides of the vent rich light violet; tail coverts long, of a hair-like texture at the sides, over which they descend, and of a deep black glossed with green; back dusky bronze, reflecting green; scapulars black; tail tapering, dark glossy green above, below dusky; primaries dusky, silvery hoary without, tipped with violet blue; secondaries greenish blue, tipped with white; wing coverts violet blue, tipped with black; vent dusky; legs and feet yellowish red, claws strong and hooked."

Female.

"The female has the head slightly crested, crown dark purple, behind the eye a bar of white; chin and throat for two inches also white; head and neck dark drab; breast dusky brown, marked with large triangular spots of white; back dark glossy bronze brown, with gold and greenish reflections Speculum of the wings nearly the same as in the male, but the fine pencilling of the sides, and the long hair-like tail coverts, are wanting; the tail is also shorter."

WOODDUCK MALE.

(Aix SPONSA. Swainson.)

Among the many beautiful water-fowl we have with us, the male wood-duck in the full glow of his autumn plumage is the most brilliant.

Sharp contrast of superb tints, and a wonderful blending of rich, warm colors combine to produce in the plumage of the male the most gorgeous effects.

Taxidermy gives us the graceful carriage and coloring, but there is lacking that indescribable sheen, or more properly bloom, that we find in life, blending its warmth and greatly enhancing the splendor of this bird's appearance.

The female is a " dainty little beauty," to my thinking.

Though lacking the gorgeous habiliments of her consort, she wears a most fascinating garb of modest duns, yellows, greys, whites and browns; is so shapely, and carries herself, withal, in so graceful a manner, as to steal right into the affections of those who have had opportunity of familiar acquaintanceship with the little wood-sprite.

These birds are mated for life and if undisturbed will return year after year to the same site for nest building in the hollow of some favorite old tree, or it may be a cosy angle in the fork of a limb that overhangs the water.

The nest is a primitive affair as to its exterior, but a downy coverlet protects the eggs within, "from eight to a dozen in number."

About the middle of May with us, the young brood is carried down to the still water, where they speedily accustom themselves to their surroundings, disappearing as if by magic on the slightest alarm; they scuttle under the drooping fronds of the ferns that border many of our inland creeks and runs, or, if it be a swamp where they have hatched, the tussocks of lush grass and weeds will instantly receive them out of sight.

Save as an occasional visitant I have never found this bird on salt meadows.

They love the silence and beauty of wooded streams, and the tangle of vine canopies that spread over still, swamp waters.

When approaching the nest, one must needs be cautious if a glimpse of the male be desired. Should he happen on the water when you arrive it is more than likely an incautious rustle will betray you, and immediately you hear a startling rush as he springs in flight through the nodding alders. But, if above in the branches of his family tree and you are adept in still hunting, you may catch him unawares.

He dearly loves to perch on a dead limb in a full blaze of sunshine, to preen.

Fortunate you are if your careful approach be rewarded by a sight of this fairy creature at his toilet.

Only once have I had this opportunity. The nest was in a huge chestnut that hung over a pool in the midst of a tangled swamp. I had stolen up unobserved, and though I knew where to look, and felt positive the bird I sought was there, still it was

17

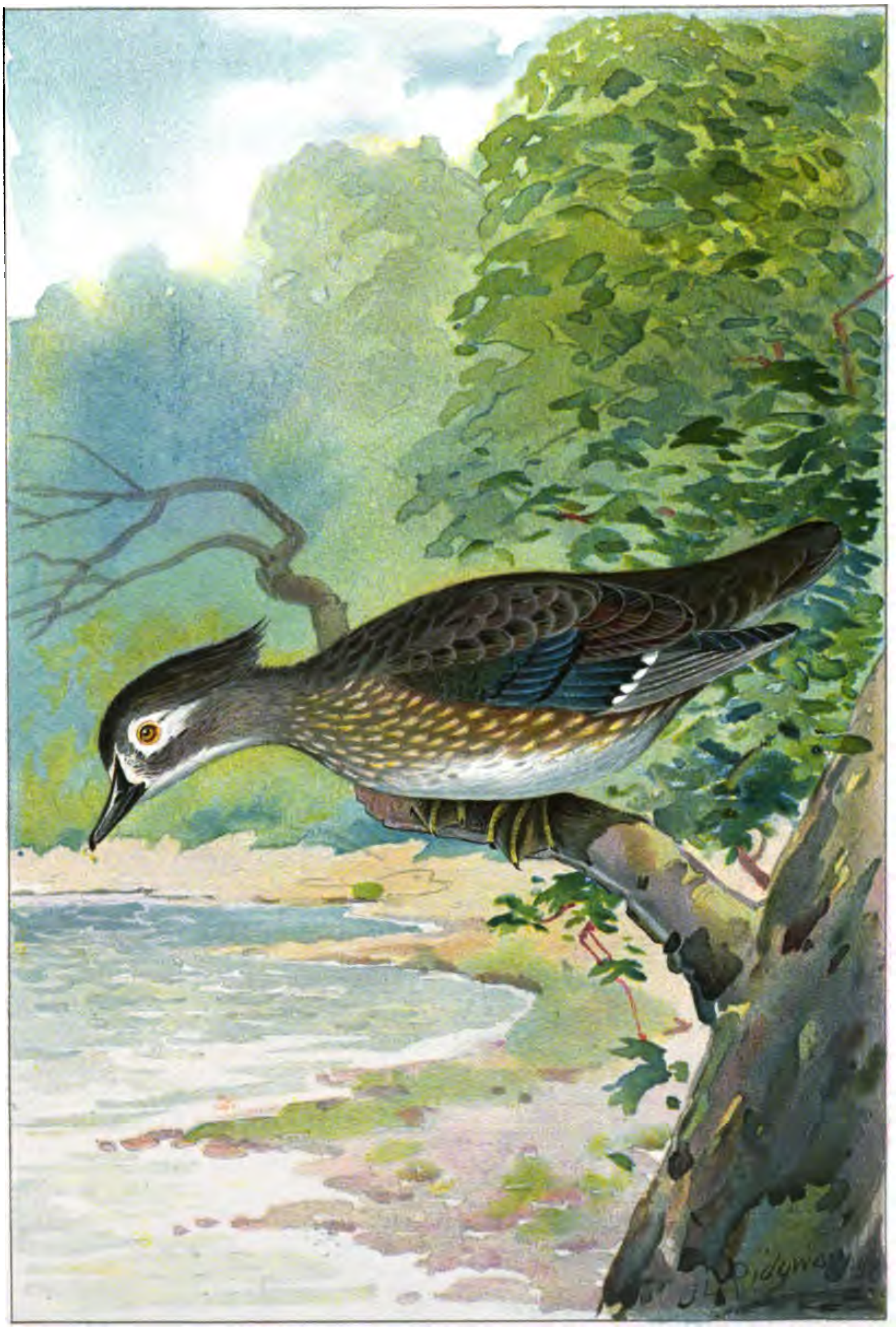
many minutes before I could locate him in spite of the fact that he stood boldly out on a dead limb in the full glare of the sunshine. After I saw him, of course I could not lose him again, but though his plumage glistened and shone so fairly, he was in such close harmony with surroundings that a casual observer might pass and repass the tree without once seeing him, had the bird chosen to remain motionless.

Nature's ways are wonderful, and it is marvellous how even the most elaborately clad of her wild creatures will blend with their surroundings, often escaping discovery by this means. If the bird discover you from his high perch as you approach you will have to look sharp to see him, for he vanishes like a glimpse of something intangible, unreal, and your ear must be sharp to catch even the faint treble of his whistling wings.

FINE PLACE FOR WOODCOCK.

The wood-duck is a shy, silent bird, altogether unlike many of our water-fowl whose loquacity often betrays their whereabouts. Often the sportsman, while pushing his canoe along some favorite stream, carefully whipping the pools as he advances, is suddenly startled as a trio of wood-duck whish-sh up from the water just ahead as the canoe with the silence of thought, almost, rounds a bend. These sylvan sanctuaries are chosen retreats of these "bright-eyed woodfolk" and here one must go to find them with certainty. Here they rear their little ones and a charming sight it is to see the family cruising along the edge of such a stream, halting here and there to glean some especially dainty morsel that offers itself.

Life with the wood-duck is not always one long, bright dream, however. The habit of basking in the sun indulged in by both male and female often gets them into trouble. In their paddling about the shallows during the early spring freshets they



WOODDUCK FEMALE.

(Aix sponsa, Swainson.)

will mount every half-submerged tree or branch, every water-soaked log that comes in the way, stand erect, flip their wings and preen for an instant (they are always fussing with their plumage) before swimming on. These half-submerged limbs and logs make what the muskrat trappers call "likely places," and many a bright little wood-duck has come to grief in the trap so carefully placed thereon.

That "Ishmael of the woods," the mink, also takes toll of them, while huge pike and pickerel are lurking below ready to engulf their fledglings with sudden swirl and splash among the lily pads.

Watching a happy family of these birds is a delightful way to pass the time. The tender concern shown by the female in the welfare of her young, the scraps of conversation carried on with her consort in soft, liquid tones to which he replies with a quiet peet! peet! are in keeping with the wood-life they lead. Like the rustle of the soft leaves and tendrils of the spring, they do not break the charm of their surroundings; on the contrary, they add a witchery that is in perfect accord.

The rapid growth of feathers makes a heavy drain on the strength of the youngsters; we find them therefore possessed of voracious appetites, always on the go after food, as an immense amount is absolutely necessary to sustain them. The supply is unlimited and varied, from bugs and beetles, to buds and berries, and those innumerable little nothings which defy your closest scrutiny. Autumn adds the acorns, mast and other dainties to their list. In perpetual motion the fuzzy little bodies wriggle and dart hither and yon, in one long, restless seeking and eating. Presently you will see one of the little puffs of down draw its head between its shoulders, give a gulp or two, and float motionless on the water as though that last morsel had been too much for it. With the glass you may see the sharp little eyes, like ink spots in the yellow fluff that covers its head. Should a luckless insect happen along just then, it will surprise you to see how quickly that "ducklet" will rouse and put after it. After some weeks of hearty feeding they have gained in size and strength, they take longer trips with their parents, and are finally piloted down to the marsh where the stream enters the lake. Should you come upon the family at this time in the open water, the old birds will take wing, while the youngsters, with prodigious flapping of wings and spattering of feet, make all speed for the shelter of the marsh. They make for cover in different directions and the calm water is streaked with as many wakes as there are individuals in the family. Too fat and adolescent to fly they flap along, and hence the name they bear at this time of life is "flappers."

They breed throughout the States, though the New England and Middle States are perhaps more favored localities. Migrant with us they leave soon after the first frost pinches the woods, to return early in spring during March and April and again take up their ideal life in familiar haunts.

The wood-duck is inclined to be solitary, holding aloof from others of its kind. I have never seen them in company with other wild fowl, except in the rice beds, where one would occasionally spring with the feeding black-ducks (*Anas obscura*). The flocks are small; rarely have I seen over seven or eight in company, three to five being the usual number. As the country becomes cleared the ponds and streams are deserted by the wood-duck, though I have known of an instance of their remaining in a certain locality while streets were being cut through a favored bit of swampy woodland, that had sheltered their nesting site for many years.

I have observed a curious habit of flight in these birds. Years ago there was a little company of some half-dozen individuals who sojourned in a swamp some three miles away from a small pond of open water some half acre in extent, in which they were in the daily habit of disporting themselves. Regularly they took the same course back and forth, flying low across the open, swinging past the same corner of a patch of woods on the way, up over a stiff hill covered with second growth and into the swamp beyond. Many times I met them at various intervals on their course, but never did they vary fifty yards either way, nor fly at a greater height than, say, twenty yards above the ground. Contrary winds would hustle them at times, but with remarkable pertinacity they kept their original line of flight.

As a game-bird for the table the wood-duck does not hold a high place. While its flesh is palatable it lacks the wild tang of that of the teal. In the autumn I have found the birds fairly numerous in various of our fresh-water marshes on the borders of lakes and would occasionally bag one or two, while hunting black-duck in such localities. They do not decoy, so far as my own observation goes, and in this I am confirmed by others. In fact, I can hardly conceive of making a special hunt for them. Where one knows the haunt of a few on some secluded stream, he might be reasonably sure of having a shot.

In the Blooming Grove Park preserve, Pike Co., Pa., is a small lake much frequented by these birds; the members often secure a few by pushing a boat into the reeds and firing at passing birds.

The flight of the wood-duck is strong and steady, like that of the teal, though not nearly so swift. They spring as does the black-duck, like a shot into the air from the reeds where they feed, affording a pretty chance for a snap shot.

As above it may be said they do not rank high as a game-bird for the table. As an object of pursuit for the sportsman they are not numerous enough in any one locality to warrant special effort for their capture, although they are likely to be taken "*en passant*" wherever our fresh-water fowl are found in autumn. These birds breed readily in captivity and are easily reared and tamed.

BAY RIDGE, N. Y.

The Wilson's Snipe.

By GEORGE BIRD GRINNELL, PH.D.

STANCH.

ALTHOUGH almost the smallest of our game birds the snipe is one of the most highly prized. It is also, on account of its very wide distribution, perhaps better known to sportsmen than any other bird which they pursue. Breeding as it does on the very borders of the Arctic circle, and extending its flights during the southern migration to the northern countries of South America, it occurs at one time or another of the year throughout the length and breadth of our land. The time was when good snipe shooting some time during the spring or fall could be had wherever favorable feeding grounds existed, but as this bird has been almost wholly overlooked by the game laws, and is shot at all times and seasons wherever found, the snipe to-day—except in certain favored localities—is becoming one of the rarest of our birds.

Notwithstanding its wide distribution and the fact that it is known to almost all sportsmen, the snipe has few local names. From its resemblance to the European species, with which, up to the time of Wilson, it was regarded as identical, it is almost universally known as "English," or "Jack" snipe. Mr. Gurdon Trumbull, in his most excellent and interesting work entitled: "Names and Portraits of Birds which interest Gunners," tells us that at different points in New Jersey and Maryland it is called "bog snipe" and "marsh snipe," obviously to distinguish it from the shore-inhabiting beach birds, which are also commonly called snipe. In an article contributed to the *Century Magazine*, in 1883, I wrote: "Few of our birds are so poor in local names as this one, for it is almost everywhere known either as the 'English' or the 'Jack' snipe. Along the New England coast, however, it has an appellation which is rather curious. As the bird arrives about the same time as the shad, and is found on the meadows along the rivers where the nets are hauled, the fishermen when drawing their seines at night often start it from its moist resting place and hear its sharp cry as it flies away through the darkness. They do not know the cause of the sound and from

the association they have dubbed its author 'the shad spirit.'" Mr. Trumbull calls attention to Nuttall's statement that in Massachussetts it is known as "the alewife bird, from its arrival with the shoals of that fish," and that in like manner, and for the same cause, on the Delaware it is called "shad bird," while in the south-eastern parts of Illinois, according to Mr. Ridgeway, the common term for it is "gutter snipe."

The English snipe makes its appearance in New York about the middle of April, seldom much earlier, and often a little later, if the weather is cold and the season backward. The first warm rain which tempts the earth worms out of the ground is pretty sure to bring with it a flight of snipe. And if the gunner knows any good ground where a few birds still stop on their migration, he will be likely to visit it after such a rain. Yet at this time the birds are usually in poor condition from their long flight from the south, and as they are preparing to breed they should not be shot. If this shooting in the spring were absolutely abolished, many more snipe would breed in New York and the Middle States than do so at present, and when the shooting season opens in the fall these local and home bred birds would by just so much increase the opportunities of the local gunner. In other words, where, by his spring shooting, he has an opportunity to kill two birds, if he would wait until the autumn he would have a chance to kill six.

The snipe has been found breeding as far south as Maryland, and there are quite a number of records of nests that have been found in Pennsylvania, New York and New England. But owing to the persistent manner in which they are shot in the spring, most of the snipe pass beyond the United States to breed, and lay their eggs in the lonely marshes of Canada.

It is this season of the year, when the days grow warm at mid-day, and the hylas in the swamp are still noisy in the evening, when violets are in bloom and the blood root blossoms show white on the borders of the wet meadows, that the drumming of the snipe may be heard. This is a part of his love making, which is quite similar in method to that of the woodcock. In the early morning, or at evening, or, when the weather is dull and cloudy, at any time of the day, the snipe may be seen to rise in wide spirals high above the earth, often almost disappearing from sight, and then to dart down from on high with stiffened wings, uttering a twittering humming call, which has been said to be caused in part by the stiff wing feathers against the air in the rapid descent, but is no doubt vocal. When he has almost reached the earth he checks his fall and then drops into the grass, or perhaps he may alight on a fence, a tree twig or an old stump, where he stands for a moment as if to be admired, and then drops into the grass. There his mate is awaiting him, and about her he struts with head thrown back, trailing wings and expanded tail, eager to win her admiration.

WILSON'S OR ENGLISH SNIPE.

(GALLINAGO MEDIA, Wilsoni.)

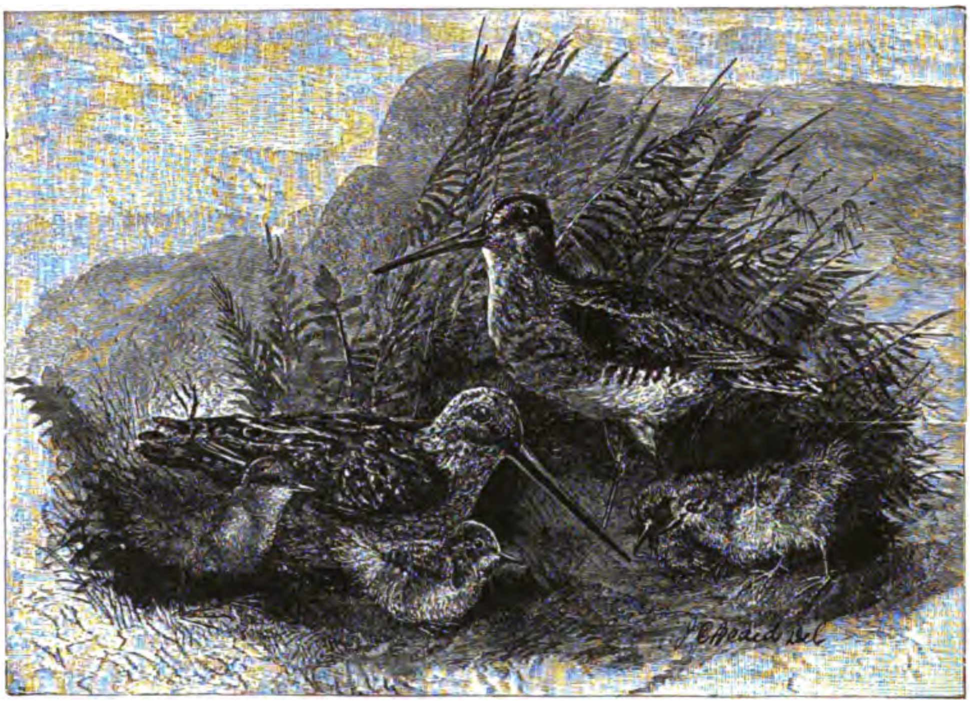
This performance of the snipe, though less familiar to us than many forms of love-making by the birds, is of course analagous to the drumming of the ruffed grouse, and the dancing of the prairie chicken, and is still more similar to the love songs of certain small birds found on the prairie, sky larks and finches, which, as they have no lofty perches from which they can sing, fly high into the air, and, descending slowly on balanced wings, utter their song until they reach the ground. The rapid fall of the snipe somewhat resembles the downward dart of the night hawk.

The nest is a primitive affair; just a little hollow in the ground, lined with a few blades of grass, in which the four eggs lie with their points all together. They are of a dull clay color, dotted and splashed with large and small spots of a blackish brown. The young leave the nest as soon as they are hatched, and run about after the mother, as do young woodcock or young grouse—in other words, they are what the naturalists call precocious (*Præcoces*). About the first of September the full-grown family turn their bills southward and jog along, at first by easy stages, toward their winter home in the south. Usually, most of them have passed on by the latter part of November, and if any remain at this time, they are sure to be big, fat, heavy and delicious. I have killed them in December, when it was quite cold and there was a thick skim of ice over all the ponds, but usually the first sharp frost, by hardening the mud, closes up their feeding grounds and forces them further along. Yet that it is not the cold, but the lack of food, which obliges them to leave us, is shown by the fact that in many places along the flanks of the Rocky Mountains and on the high plateau of the Laramie plains, where in winter the mercury often falls to –30 or –40 degrees Fahrenheit, a few snipe are regularly found during the winter about certain warm spring holes which never freeze. That if a bird has plenty of food it does not mind a great degree of cold is still further emphasized by the fact that in this same region many ducks winter in all the warm pools and eddies which do not freeze.

Snipe are notorious for the uncertainty of their appearance and for the apparently causeless way in which they vanish again. No doubt the two factors which influence them in these respects are the weather and the food supply. If they come into a meadow which looks like a good feeding ground, and after having tested it find it barren, they promptly move on to some other ground. The snipe is a voracious bird like the woodcock, and the character of its food is such that it must be necessary for it to eat at very frequent intervals. Its food consists very largely of earth worms and insects found among the grass on the wet meadows, which it frequents. Like its cousin, the woodcock, it procures the chief portion of its sustenance by "boring," that is to say, by probing the soft mud with its swollen tipped, sensitive bill, by which it probably feels any motion in the soil, and thus detects the presence of its food. The nerves in the bill of the woodcock and snipe have been studied to some extent and

one may imagine that the heads of these two species would prove interesting subjects to the anatomist. Snipe in confinement have been known to eat bread and milk and cornmeal.

Although the snipe's erratic ways of coming and going are proverbial, it is yet not an easy matter to drive him away from a given place when he does not wish to go. He is an obstinate little fellow, and when he has found a feeding ground that suits him, chasing him about over it is not likely to make him leave. It is a common experience to have a snipe get up wild before one and rise high in the air, as if intending to go a great distance, and then, after flying in wide circles high above the



FROM DRAWING BY JAMES C. BEARD.

A FAMILY OF WILSON'S SNIPE.

meadow to see it at length return and pitch down almost in the very spot from which it rose. It is not likely to do this unless the gunner stands perfectly still until it has alighted, and after its return a little time should be given it to begin to feed again, or else it may rise once more and take its permanent departure. I recall an occasion when I saw this attachment to locality exemplified at some well known snipe grounds in Indiana, where, by good fortune, I found birds in great numbers. These grounds were not very extensive, but the great number of snipe made the shooting puzzling. We worked the marshes over two or three times until all the birds had gone, and then my companion and I separated to explore the neighborhood in the two directions in

which the birds had chiefly disappeared. I proceeded through a piece of dry woodland, thinking that perhaps beyond it there might be another marsh. To my astonishment, soon after I had entered the woods, snipe began to rise about me in all directions. There must have been hundreds there. My companion crossed a high cultivated hill to see if beyond that there was a slough. When he reached the top of the hill, where there was a dry, potato lot, snipe rose from every furrow that he passed, and whirling about, went back to the marsh we had just been shooting on. So it seems that, simple though he is thought to be, the snipe is wise enough, when he is much harried on a favorite feeding ground, to go away to some place where he would never be looked for, and there await the departure of the disturber of his peace.

In these days when snipe are scarce and hard to find, a good dog is sometimes very useful in saving much laborious walking to the gunner, and in retrieving most of the birds that he may kill. Moreover, there is no more beautiful place to see dogs work than the open meadows where snipe are usually found. On the other hand, they often wholly decline to lie to a dog, getting up wild before him, and so much further from the gun than they otherwise would; or if they are very numerous, they puzzle and confound the dogs by their numbers and the fact that they have passed over the ground in all directions. On the whole, a dog is less useful in snipe shooting than in the pursuit of any other bird. Yet there are times when the snipe are fat and lazy and lie well, when a dog is very much needed. Then they will let you pass within a few feet of them without rising, and it is impossible to see them unless they move. The subject of protective coloring is familiar to the sportsman, for we all know how hard it is to see a quail or a grouse crouched in grass or weeds before the dog's nose, a night hawk sitting on the rock, or a deer in the woods or lying on a bare, rocky hillside, unless it moves. Few birds offer better examples of protective coloring than the snipe; its blacks, browns, chestnuts and buffs harmonizing wonderfully well with the yellow grass among which it lives, and the shadows and openings beneath the grass. So true is this that even when looked at directly the snipe is not likely to be seen on the ground except by chance. I once saw one of these birds feeding along the edge of a little slough on the bare black mud where his color and his motion caught my eye at once. A moment later the snipe saw me, and walked quickly to the side of a small tuft of grass, where it squatted close beside the grass stems, against which it could hardly be detected. I took my eye from it two or three times, and on looking at it again was obliged really to search for it before I could make out the bird's outline. Of course as my eye became more familiar with the spot and with the situation of the bird I found it more and more easily each time.

This protective coloring makes it often difficult to see a dead snipe lying on the ground, unless it has been closely marked down, or has fallen on its back so that the

white belly shows; and so a good retriever is a real help in snipe shooting, for he will find many birds that would otherwise be lost. Most men, unless they are in constant practice, grow careless about marking down their birds, a matter which at first requires keen attention and close observation. If these are applied intelligently for a time, the marking of the birds becomes at length more or less automatic and is not a matter that one need think much about. As I said in the article above referred to, "without considerable practice it is not easy to mark down a dead bird so accurately that you can walk direct to it. This becomes especially difficult when several of the birds rise together, or nearly so, and you shoot first one and then another, and then perhaps try to mark down the remainder of the whisp. You have a general idea of the direction in which the first one fell, and are sure that the second dropped close by a certain little bunch of grass; but when, after having strained your eyes after the living and marked them down, you turn your attention to the dead, you are likely to find yourself somewhat perplexed. You see now that there are a dozen little bunches of grass near where the second bird fell, any one of which may be that by which you marked him; and as for the first, you feel very hopeless about being able to go within twenty yards of where it dropped. So you may lose half an hour of valuable time in searching for the dead. Practice in marking and a quick eye will after a while enable you to retrieve your own birds successfully. As a matter of fact, there is always something—a bunch of grass, a bit of drift stuff, a flower, a leaf, or a weed stalk—near your bird which is unlike anything else close to it; and you must see this object, whatever it is, and remember it, in the instant's glance that you have."

During the winter the southern States offer good snipe shooting. Many of the marshes lying along the bays and sounds which extend from North Carolina to Florida are favorite feeding grounds for these birds, and here they can usually be found in numbers. Perhaps the marshes of North Carolina, along Currituck Sound, are the most northern points where snipe winter in considerable numbers, and even here they are not altogether permanent winter residents, for they oscillate back and forth with the weather, appearing on the marshes when it is warm, and moving south again if a cold snap or freeze comes, only to reappear as the marshes grow soft once more. On such marshes it is possible still to have fairly good snipe shooting now and then, though even there the birds are not nearly so plentiful as they were a few years ago; and here the northern gunner who has gone south for the duck shooting, tramps for snipe on the lay days which a wise legislature has provided by a statute for the enforcement of which it furnishes neither men or money.

There is no prettier sport than snipe shooting, when the birds lie well, and none more tantalizing than when they act as they often do, giving you at rare intervals a long shot and then disappearing no one knows where.

Most gunners who have fairly considered the subject will agree, I think, that if we are to continue to have any snipe shooting, the season in all the States should close January first. In the northern States this would mean that snipe shooting, like that of other game birds, should be confined to the autumn months, and that when they arrive in spring and are already mated the birds should not be disturbed, but allowed to continue their journey unmolested, or to breed with us. The faith in the necessity of putting an end to spring shooting, if we are to continue to have any snipe or wild fowl, is growing slowly, and will before long become general, and until this further limit is set on the use of the gun, ducks and snipe will continue to diminish in numbers. Perhaps nine-tenths of the shooting done to-day is at inanimate targets, and unless some earnest steps are taken to preserve our game birds, those who care only for field shooting may have to put away their guns for all time.

SNIPE BOG.

Report of the Superintendent of Forests.

To the Commissioners of Fisheries, Game and Forests:

GENTLEMEN:—I have the honor to submit herewith my annual report on the forests of New York, both public and private, so far as they are related to forestry matters of a general character—the increasing area of the public preserve, the annual product of the woodlands that are not controlled by the State, the damages from forest fires during the past year, the suppression of timber thieving, and other subjects connected with the work of the Forestry Department.

The total area of the State of New York, land and water, is 32,129,920 acres. The assessed acreage, not including Kings, Queens, and New York counties, is 28,118,284 acres. The total area of woodlands is estimated, approximately, at 7,065,000 acres. Of the latter amount, the Great Forest of Northern New York includes 3,588,803 acres of contiguous woods, as computed from the assessment rolls of the forest towns, in which the acreage of each lot is stated, together with a description of its character, whether forest, waste, denuded, or burned. The four Catskill counties, Ulster, Greene, Delaware and Sullivan, contain large forests whose area is estimated at 1,565,000 acres. The combined woodlands of the State cover about twenty per cent. of the entire territory, and include not only the great forests of the Adirondacks and Catskills, but the smaller woodland tracts and groves scattered throughout the farming counties. The percentage is less than that of Germany, but more than that of France.

With the exception of the Adirondack forest it is difficult to arrive at any accurate figures for the wooded areas. There has been no State census since 1875; and the census then taken of our woodlands contained so many errors that it cannot be accepted as reliable.

The United States census of 1890 offers little or no information on the subject. If the actual forest area of this State is to be determined it will have to be done through work and methods inaugurated by this department.

The area of the Forest of Northern New York has been accurately ascertained and classified through statistics prepared in this office, from which it appears that there are 3,588,803 acres in that territory.

The Adirondack Park which is situated within the Great Forest, contains 3,004,855 acres, the area within the blue line as shown on the last edition of the Adirondack Map. The lands within the boundaries of this tract have been carefully classified, with the following result:

	ACRES.
Primitive forest,	1,139,593
Lumbered forest,	1,627,955
Denuded lands,	61,009
Waste lands,	22,424
Burned areas,	18,220
Water surfaces,	59,111
Wild meadows,	724
Improved land,	75,819
	3,004,855

By the term Primitive Forest is meant the lands on which there have been no lumbering operations, and on which all the spruce, hemlock, balsam, and hardwoods are still standing. Much of the white pine was removed from the Adirondack region over forty years ago. But at that time no spruce was cut, and so the term primitive or "virgin" forest means to-day the tracts on which all the spruce is still standing together with the other species. There are several townships, however, on which the white pine still remains, and on which no lumberman ever swung an axe. These tracts reveal a primeval forest in all its wonderful characteristics, and present the same appearance that they did before the white man ever traversed their lonely wilds.

The term Lumbered Land, as used in the preceding table of areas, includes the tracts from which the spruce, and, perhaps, some other conifers, have been removed, but on which the other species still remain, forming, for the most part, a hardwood forest whose dense shade and tangled undergrowth enables it to exercise, unimpaired, all its protective functions. The proportion of spruce is generally so small that its removal makes little change in the appearance of the forest or decrease in the mass of foliage. After three or four years, when the tops and limbs left by the lumbermen have been crushed to the ground by successive snowfalls and rotted there, and the underbrush has concealed the stumps, persons unacquainted with the composition of these forests would not notice any trace of the log chopper's work. Seated in a boat on some Adirondack lake and viewing the densely wooded slopes that rise on every side like some grand amphitheatre, one can determine the lumbered portions only by the absence of the spruce tops which no longer appear at intervals above the foliage of the broad leaved trees. There are places, however, where the spruce and hemlock grow in clumps, and where their removal is very apt to be followed by a clearing.

In the item of lumbered lands is included, also, some tracts which were cut over several years ago, before the pulpwood industry with its cutting of small spruces became such a prominent feature in forest operations. On such lands there remains to-day a considerable amount of merchantable spruce, both sawing timber and pulpwood, resulting from the growth of the smaller trees which were left by the lumbermen when they operated there years ago, but not enough to warrant their classification with the lands of the first class.

The term Waste Lands, taken from the Comptroller's printed instructions to assessors, includes lands that are not denuded, but which are covered with a scanty, scrubby growth of trees that prevent their classification in the second item.

It may seem strange that there are 75,819 acres of Improved Land within the boundary of the Adirondack Park. But there is a population of 15,832 people living there, not including summer residents or the transient occupants of the logging camps. Within the Park are situated the villages of Indian Lake, Sageville, Wells, Old Forge, Long Lake, Saranac Lake, Tupper Lake, Lake Placid and several small hamlets. The highways running through the Park, in Franklin, Hamilton and Essex counties are bordered with mountain farms that in the aggregate include many thousand acres of cleared land and pasturage.

The total area of the Forest Preserve, or lands owned by the State, is, at present, 1,215,821 acres, of which the Adirondack Preserve contains 1,159,309 acres, and the Catskill Preserve, 56,512 acres.

There seems to be a general misunderstanding as to the proper use of the terms Forest Preserve and Adirondack Park. The terms are not synonymous, but represent areas widely different in size, location and ownership. Many of our forestry friends forget that the Forest Preserve, as defined by law, includes only the lands owned by the State in sixteen specified counties, including the four Catskill counties, while the Adirondack Park includes all the land, both public and private, within certain Adirondack towns—an area three times that of the Forest Preserve; and, that there are many small, scattered tracts in the Adirondack Preserve which are situated outside of, and a long way distant from, the Adirondack Park.

I have noticed repeatedly, that persons in writing about Adirondack matters speak of the State as buying land in the Forest Preserve, meaning the Adirondack Park, and forgetting that the State already owns the Forest Preserve; and, that such ownership, and that only, makes the land a part of the Preserve. A remarkable instance of this misuse of the term Forest Preserve occurred in the amendment to the forestry clause of the new State Constitution, submitted to the people in 1896, an error which would have rendered that section of the amendment inoperative even if the people had voted affirmatively.

The portion of the Forest Preserve, which, for convenience, is designated as the Adirondack Preserve, contains, as already shown, 1,159,309 acres. The Adirondack Park contains within its boundaries 3,004,855 acres, of which the State owns 1,003,805 acres, leaving 155,504 acres of the Adirondack Preserve which are situated outside the "blue line," or Park boundary, as shown on the map issued by this Department.

It will be seen from these figures that the State has acquired about one-third of the land within the Adirondack Park. About one-third is still owned by the lumbermen and woodpulp manufacturers; the remaining third is owned mostly by clubs or individuals, who hold the land as private preserves. A list of these clubs and private preserves, with the acreage of each, may be found in the annual report of the Forest Commission for 1893. The total area of the private preserves at that time was 941,036 acres. Since then the State has bought some of these private lands, while, on the other hand, new clubs have been organized and new preserves established. At present, the land in the Adirondack Park is owned as follows:—

	ACRES.
State lands,	1,003,805
Lumber and pulp companies,	1,061,050
Private preserves,	940,000
	3,004,855

The portion of the Forest Preserve situated in the counties of Delaware, Greene, Sullivan and Ulster, contains 56,512 acres. These lands are designated as the Catskill Preserve to distinguish them from the State holdings in Northern New York. Nearly three-fourths of this acreage is in Ulster county, on the Slide Mountain Range of the Lower Catskills, and in the towns of Denning, Hardenberg, and Shandaken.

In addition to the 56,512 acres of State land in the Catskill Preserve, there are several thousand acres of wild or forest land belonging to Ulster county which were acquired at county tax sales. These county lands are situated in the immediate vicinity of the State lots, and in some places are interspersed with them. By the provisions of chapter 259, Laws of 1897, the county of Ulster was authorized and empowered to turn these lands over to the State upon the payment of such taxes as might be due on them, including the taxes for which they were sold. Under this arrangement the Catskill Preserve has been largely increased. But this accession is not included in the 56,512 acres, as the transfer has not been completed, and hence the acreage of these county lands is not definitely known at present.

Under the terms of the Act referred to, the Commission was authorized to select from the Ulster county lands such lots as might form a desirable addition to the Forest

Preserve. Acting under your instructions I accordingly held a conference with the county authorities, after which I selected such lands as were advantageously located for forestry purposes and the establishment of the proposed Catskill Park. But, owing to delay in adjusting the amounts due from the State, combined with complications arising from doubtful titles the list of lots to be transferred has not been completed.

Reference has been made here to the "blue line" which appears on the Adirondack Map issued by this Department. Contrary to the general understanding, this line does not represent the actual, or legal, boundary of the Adirondack Park; it is a proposed boundary only, and is so stated in the legend on the map. The present law relating to the Park defines its territory by specifying certain towns. This is well enough as to the interior; but some of the towns along the border are only partly covered with forests, the remainder being cleared and under cultivation. As a result the Adirondack Park contains over 400,000 acres of farming land. To remedy this error a line has been traced which conforms substantially to the outer border of the forest, and this line, which is shown in blue on our map, is respectfully submitted as the proper boundary of the Park. The law should be amended by the adoption of this "blue line." Owing to the large amount of farming land now included in the Park, the Forest Preserve Board has confined its purchases to territory within the blue line, a policy which does not conflict with the law governing purchases, because this line is wholly within the area of the Park as defined by Act of Legislature.

In establishing this proposed boundary no survey is necessary, for it follows the well known lines of various tracts and patents, and, in some places of towns and counties.

It is not claimed that the "blue line" includes the entire forest; to include it all would be injudicious and impracticable. Along the forest border are spurs of woodland that project into the farming districts, making an irregular boundary that could not be followed as a suitable Park line, and which would not coincide with the surveyed lines of any tracts, patents or lots. While no attempt has been made to lay out a Park with a symmetrical outline or geometrical figure, it is obvious that the boundary should be constructed with prolonged tangents and as few irregularities as possible.

On the eastern side of the Park the line conforms to the outer edge of the forest so far as practicable, on account of the important interests dependent on the protection of the Hudson watershed and feeders of the Erie and Champlain canals. The zigzag line along the Schroon River Valley is due to the irregular line of the Road Patent which was used for several miles as the boundary of the Park, a careful examination of the ground showing that this line with its wooded ridges was preferable to that of the river itself with its farms and meadow lands.

But along the northern, western, and southern boundary it was deemed advisable to leave a fringe of forest land outside the line to supply the wants of the resident population who must have some place from which to obtain their supply of building material, fencing and fuel, none of which can be obtained from the State forest, owing to the restrictions in the forestry clause of the new constitution. This matter of fuel has become a troublesome question in some localities along the eastern border of the Park, where the State ownership extends to the extreme edge of the forest.

In a previous report to the Legislature this Department urged the propriety of establishing a forestry experiment station on some part of the Forest Preserve. The suggestion then made has proved fruitful, the State having purchased a tract of land recently for that purpose. The management of this forest tract has been entrusted to Cornell University by Act of Legislature; and by the same law the University is "authorized and empowered to create and establish" the "New York State College of Forestry," for the maintenance of which an appropriation is also made.

The original plan, as suggested by this Department, for undertaking something in the line of conservative forest management, contemplated some experimental work with a view to ascertaining what permanent revenue a tract of primitive forest would yield when the amount of the annual cutting was not allowed to exceed that of the annual growth.

The matured trees, having been marked, were to be sold to the highest bidder, who, in removing them, would be subject to such restrictions in road building, felling of timber, and protection of young trees, as an intelligent system of forestry would require. Part of the revenue thus obtained could be set aside for forest improvement and increasing the productivity of the tract; the balance could be turned over to the State. Such an experiment could have been carried on from the start without asking the State for any money, the extent of the operations being governed by the revenues previously received. Starting with a tract of primeval forest already grown, such an experiment would have involved no expenditures by the State; it would have been economical and instructive, and, it is hoped that in time some such work can yet be undertaken. But the forestry clause of the new State Constitution prohibits anything of the kind on the part of the State; and so the plan was necessarily entrusted to a second party, to whom the land was deeded in trust. The State, accordingly, bought a tract of 30,000 acres of forest land, situated in townships 23 and 26, Franklin county, which, under the provisions of the law (see Appendix), is placed under the management of the State College of Forestry of Cornell University. The plan of operations contemplated by the College officials is far more extensive than the simple experiment proposed by this Department, but it is hoped and confidently expected that the undertaking will prove successful.

As we are prohibited by law from attempting anything like forestry or forest improvement, the work of the Department has been confined as usual to duties of a police character, the suppression of timber thieves and prevention of fires.

So far as I can learn from the reports of the foresters and my own observations there has been no timber cut on State lands during the year 1897, other than some petty trespassing. In no place have the axemen of the lumber companies crossed the lines and cut timber on State lots. The few depredations that occurred were committed by residents who wanted some building material or fuel. During the year there were thirty-eight cases of timber cutting on State land, each of which was duly prosecuted. The judgments rendered in these cases amounted, in all, to $2,825.99.

The amount seems small as compared with the wholesale cutting on State land that prevailed when the Forestry Department was first organized, and for which, in repeated instances, individuals and companies were made to pay $5,000 or more in settlement of damages. But such depredations are no longer possible; the cutting could not progress far before it would be stopped. If it were undertaken on disputed territory, the State would promptly procure an injunction restraining any such operations until the title could be decided.

Under the provisions of the foresty law the firewardens of the various towns are required to report annually the fires in their respective districts, together with a statement of the number of acres burned over, the amount of damage, and the cause of the fire. These reports having been collated and tabulated, it appears that there were ninety-eight fires during the year; that the aggregate area burned over was 26,:87 acres; and that the total amount of damages was $26,941. Of the burned area, 2,105 belong to the State.

Much of the burned territory reported by the firewardens consisted of land on which there was only a scant growth of trees and no merchantable timber; a large portion also consisted of wild or waste lands, partly covered with dwarfed trees or bushes. Some of the tracts were mere barrens that were burned over for the second or third time, the ferns and brush having been fired intentionally by berry pickers to increase the yield of fruit. Hence, the total damages are not as great as the acreage would indicate.

Although much of the burned area consisted of lands that were worthless before the fire ran over them, these burnings are a greater evil than any measure of damages would indicate, because they prevent any future growth of timber. It will be almost impossible to reforest these areas that have been fired repeatedly, for the heat destroys the soil itself, consuming the vegetable mold and leaving nothing but barren sand or rock.

There were several small fires reported which are not included in this tabulation, because the scorched areas and the damages were insignificant. These fires were observed at the start, and were promptly extinguished before the flames had time to spread.

Most of the firewardens are active, efficient men, and good fire fighters; but some of them are worthless and should be discharged. I am confident that the number and areas of the fires could be reduced materially if there were only a better organization of the force of firewardens. There are 281 town firewardens, each of whom is a law unto himself. They are apt to feel independent of rules and regulations, for they receive no salary, and are paid only for the actual time that they are fighting fire. Their efficiency would be greatly increased, and the damage from fire decreased, if some competent man were appointed to supervise their work, and devote his entire time to the proper enforcement of the various paragraphs in the forestry law relating to the prevention of fire.

In the following tabulation it will be seen that few of the firewardens report the cause of the fire, although the law requires them to do so, and their attention has been repeatedly called to their failure in this respect. In some cases they may have been unable to ascertain the cause; but, more often, they knew the reason, and refrained from stating it to avoid trouble with their neighbors. If there was a chief firewarden, as just suggested, he would visit the scene of each fire, find out the cause, and prosecute the guilty party whose careless or wilful act caused the mischief.

Report of Forest Fires

From October 1st, 1896, to December 31st, 1897.

Clinton County.

TOWN	DATE		ACRES	DAMAGE	CAUSE OF FIRE
Black Brook	October	13	400	$100 00	Unknown
Black Brook	June	26	300	100 00	Unknown
Black Brook	October	15	25	20 00	Unknown
Dannemora	October	5	50	100 00	Fallow fire
Dannemora	October	19	300	400 00	Incendiary

Essex County.

Elizabethtown	May	8	30	$81 00	Brush fire
Lewis	June	28	20	......	Fallow fire
Lewis	September	9	50	300 00	Lumber shanty
Lewis	October	26	25	25 00	Hunters
Moriah	May	9	200	75 00	Unknown
Chesterfield	October	29	400	300 00	Unknown
Minerva	October	24	20	15 00	Unknown
Wilmington	October	5	400	500 00	Unknown

Franklin County.

Altamont	May	10	15	$150 00	Unknown
Altamont	October	1	25	125 00	Unknown
Altamont	October	19	12	40 00	Unknown
Altamont	October	27	150	100 00	Unknown
Franklin	May	9	30	25 00	Unknown
Malone	June	17	10	.....	Fallow fire
Malone	October	1	350	1,000 00	Unknown
Malone	October	2	800	2,000 00	Unknown
Malone	October	4	75	100 00	Fallow fire
Malone	October	10	500	1,500 00	Fallow fire
Malone	October	11	300	800 00	Unknown
Malone	October	1	200	1,000 00	Unknown
Moira	September	30	500	800 00	Unknown
Moira	October	1	150	600 00	Unknown
Moira	October	1	40	100 00	Locomotive

FRANKLIN COUNTY.—Continued.

TOWN	DATE	ACRES	DAMAGE	CAUSE OF FIRE
Moira	October 25	10	$20 00	Locomotive
Bellmont	October 20	700	700 00	Unknown
Brandon	October 10	200	35 00	Hunters
Brandon	October 10	100	20 00	Fallow fire
Brandon	October 12	150	100 00	Unknown
Dickinson	October 11	250	10 00	Fallow fire
Dickinson	October 18	600	750 00	Hunters

FULTON COUNTY.

Caroga	May 7	150	$400 00	Unknown
Caroga	May 9	150	200 00	Unknown
Johnstown	April 24	100	200 00	Unknown
Johnstown	April 25	40	75 00	Children
Stratford	May 8	100	100 00	Unknown

HAMILTON COUNTY.

Wells	October 23	200	......	Carelessness of smoker

HERKIMER COUNTY.

Salisbury	October 20	1,500	$300 00	Children
Russia	October 27	25	30 00	Unknown

LEWIS COUNTY.

Croghan	October 15	200	......	Unknown
Greig	May 20	40	.....	Unknown
Greig	June 28	25	$25 00	Unknown
Greig	July 9	50	50 00	Unknown
Diana	October 11	150	.....	Unknown
Watson	May 18	150	100 00	Fallow fire

St. Lawrence County.

TOWN	DATE	ACRES	DAMAGE	CAUSE OF FIRE
Clare	October 21	600	$800 00	Incendiary
Pitcairn	October 12	150	300 00	Unknown

Saratoga County.

Edinburgh	October 26	100	$100 00	Unknown
Hadley	October 21	400	800 00	Unknown
Hadley	October 24	200	300 00	Unknown

Warren County.

Caldwell	October 21	150	$350 00	Burning shanty
Johnsburgh	October 24	300	150 00	Hunters
Luzerne	October 16	75	......	Hunters
Luzerne	October 19	350	200 00	Hunters
Warrensburgh	May 8	100	......	Unknown
Warrensburgh	October 18	350	200 00	Unknown

Washington County.

Fort Ann	April 2	30	$75 00	Children
Fort Ann	October 24	150	150 00	Hunters
Fort Ann	October 24	75	200 00	Hunters
Fort Ann	October 24	30	100 00	Hunters
Whitehall	October 20	1,500	1,500 00	Unknown

Delaware County.

Colchester	October 20	150	$100 00	Unknown
Hancock	May 9	100	150 00	Incendiary
Hancock	October 12	300	300 00	Unknown
Hancock	October 15	350	400 00	Unknown
Hancock	October 17	400	600 00	Unknown
Hancock	October 24	200	300 00	Unknown
Hancock	October 26	250	300 00	Unknown

GREENE COUNTY.

TOWN	DATE	ACRES	DAMAGE	CAUSE OF FIRE
Cairo	October 26	60	$200 00	Unknown
Catskill	October 28	150	100 00	Incendiary

SULLIVAN COUNTY.

Benthel	April 24	200	$50 00	Incendiary
Fallsburgh	October 21	15	25 00	Incendiary
Forestburgh	November 1	200	......	Unknown
Forestburgh	October 27	150	......	Unknown
Forestburgh	October 31	75	150 00	Unknown
Freemont	April 14	50	20 00	Locomotive
Freemont	April 24	150	75 00	Unknown
Highland	March 30	900	900 00	Incendiary
Highland	October 28	500	500 00	Unknown
Lumberland	April 29	300	1,000 00	Unknown
Lumberland	May 9	150	......	Unknown
Lumberland	October 17	150	150 00	Unknown
Lumberland	October 2	150	......	Unknown
Rockland	October 18	200	200 00	Hunters
Rockland	October 18	300	300 00	Fallow fire
Rockland	October 20	100	50 00	Fallow fire
Rockland	October 22	700	700 00	Unknown
Thompson	October 28	75	75 00	Berry pickers

ULSTER COUNTY.

Denning	October 21	3,000	$200 00	Unknown
Shawangunk	October 25	1,500	750 00	Hunters
Wawarsing	May 20	60	100 00	Unknown
Wawarsing	May 31	60	200 00	Unknown
Wawarsing	June 27	15	50 00	Incendiary
Wawarsing	October 17	400	300 00	Unknown

SUMMARY.

COUNTIES	NUMBER	ACRES	DAMAGE
Clinton,	5	1,075	$720 00
Essex,	8	1,145	1,296 00
Franklin,	22	5,167	9,975 00
Fulton,	5	540	975 00
Hamilton,	1	200	....
Herkimer,	2	1,525	330 00
Lewis,	6	615	175 00
St. Lawrence,	2	750	1,100 00
Saratoga,	3	700	1,200 00
Warren,	6	1,325	900 00
Washington,	5	1,785	2,025 00
Delaware,	7	1,750	2,150 00
Greene,	2	210	300 00
Sullivan,	18	4,465	4,195 00
Ulster,	6	5,060	1,600 00

RECAPITULATION.

Number of fires,	98
Number of acres of land burned,	26,187
Damage by fire,	$26,941

The origin of the fire was reported in forty cases only. These causes are summarized as follows:

From Burning fallows,	11
Hunters and fishermen,	11
Incendiaries,	8
Railroad locomotives	3
Children at play,	3
Burning buildings,	2
Berry pickers,	1
Careless smoker,	1

In the remaining cases the cause was reported by the firewardens as unknown. This failure to state the origin of the fire was due partly to inefficiency in ascertaining it, and partly to reluctance in furnishing the information when the cause was known. Nearly all the fires were on the outskirts of the forest; and for this reason it may be safely assumed from previous experience and personal observation, that, of the sixty cases reported as "cause unknown," three-fourths of them originated in brush fires started by farmers, in violation of the law, and from which the flames escaped into the woods.

The provision of the law requiring a statement as to the means used in fighting or extinguishing the fire was generally complied with by the firewardens in their reports. From the information thus furnished it appears that the common method used in stopping a small fire was by whipping it out with brush, after which fresh dirt was thrown on the smoking leaves and embers; or, if there was water near by, it was carried in buckets and poured over the ground. Where the fire had gained a good headway and spread beyond control, a line of defence was chosen along some road or stream, from which back fires were started. In some places where there was a slow ground fire, and the soil would permit it, furrows were ploughed and a space was swept bare of leaves and combustible material, thereby making a line at which the creeping flames stopped for lack of fuel. In most cases where the fire covers a large area, the men work in the early and late hours of the day, or in the night; for then the flames die down, and can be fought easier than in the daytime or noon hours, during which they burn with uncontrollable fury.

In the case of a "top" fire, driven by a strong wind, little or nothing can be done to stop it, aside from extinguishing the small fires that start on all sides, lighted by falling sparks or brands. Sometimes, a sufficiently large posse of men having been warned out, a top fire has been encircled by a cordon of fire fighters, back fires started, and the conflagration held in check until rain came to their relief. With few exceptions, our larger forest fires in the Adirondack and Catskill regions burn until rain comes. Fortunately, in the spring and fall, the times when all our woodland fires occur, the rains are most frequent, especially on the mountain plateaus where the forests are situated; and a fire seldom lasts four days without being extinguished by some opportune downpour. The frequency with which showers follow forest fires has led to a prevalent belief in the certainty of this phenomenal succession as an ordinary exhibition of cause and effect. Rain is the best firewarden we have, and were it not for this agency there would be no forests to-day on the Adirondack and Catskill uplands. But, it is hoped that through some better organization and management of the firewardens our forest fires can be prevented or extinguished without dependence on any such fortuitous agency.

I submit herewith, also, the usual annual compilation of statistics showing the product of the Adirondack forests for 1897. These statistics show the amount of timber consumed by the sawmills and pulpmills, but do not include the minor products of the forest. Although none of this timber is cut on State lands, and the work is in no way connected with the duties of this Commission, still, the information furnished by these tables is absolutely necessary to a correct understanding of the forestry situation in the Adirondacks. The extent of our future supply of merchantable timber, and the change in forest composition can be ascertained only through these statistics.

In compiling these figures the greatest care has been exercised in order to obtain accuracy so far as it is possible with this peculiar class of statistics. The results are not based on hasty or careless estimates; the product of each sawmill and the number of cords consumed by each pulpmill is taken from the written statements furnished by the respective individuals or companies.

From the footings of the reports made by the mill owners, it appears that, in 1897, the timber cut in the Great Forest of Northern New York amounted to 450,995,416 feet B. M. The different species removed were in amount as follows:

Spruce—sawmills,	188,353,586	feet.
Spruce—pulpmills,	166,087,872	"
Hemlock,	55,656,579	"
Pine,	26,120,055	"
Hardwoods,	14,777,324	"
Total,	450,995,416	feet.

The two items of spruce amount to 354,441,458 feet, and, assuming that, on an average, this species would yield 4,000 feet per acre, it follows that the merchantable timber was taken from 88,000 acres during the year, and that the people of our State are that much nearer the end of their timber supply.

In placing the average yield of spruce at 4,000 feet per acre, including the pulpwood, I have in mind the "scale bills" or log measurements of various townships and tracts where the total amount of spruce cut is a matter of record. It is understood that there are tracts on which the spruce will overrun this amount; and that there are places where the spruce clumps yield a phenomenal amount of timber per acre. On the other hand there are large tracts on which, by reason of hardwood ridges, balsam groves, cedar swamps, windfalls, burned areas, beaver meadows, and lake surfaces the amount of standing spruce is far below the average mentioned. A township may have many places on which the spruces are large and numerous, their tall, straight shafts standing so thickly in clumps and groves that they attract attention and are often referred to as a remarkably fine display of timber; and, yet, when the township is lumbered and the total number of feet cut is divided by the 25,000 acres or more in the tract, the average number of feet per acre has often been a surprise and a disappointment.

As already shown, the area of lands within the Adirondack forests that have not been lumbered approximates closely to 1,139,593 acres, including both State and private holdings. After making due allowance for the small spruces which still remain on some of the lumbered lands it would appear that the remaining supply of spruce

will not exceed 5,000,000,000 feet. Hence, if the present rate of cutting continues this species will be exhausted in fourteen years, and with it, also, the pine and hemlock.

I am aware of the well known fact that timber lands are very apt to hold out better than the estimates; but after allowing for this peculiarity, it is evident that, aside from the timber on the State Preserve, the end of the spruce supply is plainly in sight.

To suggestions of this kind many will point complacently to the supply of timber in the Canadian forests, from which a large amount of pulp timber is being shipped annually to the pulpmills of this State. But when the supply of spruce in New York and New England is exhausted the Canadian government will be at liberty to place an export tax on spruce timber or pulp to compel the paper manufacturers to build their mills and carry on their industries in that country. The Canadian press is already demanding an export tax on pulpwood and saw logs; but such a tax will not be levied, probably, until the supply on the American side is exhausted.* So, the time may come when the large timber reserve on the State lands may not only supply the raw material for certain industries, but may prove an important factor in regulating the lumber tariff.

* Since the above was written, the Canadian government has authorized an export tax on logs.

GREAT FOREST OF NORTHERN NEW YORK.

LOCATION OF MILLS	NAMES OF MANUFACTURERS	SPRUCE
Beaver River, N. Y.	F. Ouderkirk	8,000,000
Benson Mines, "	James L. Humes	....
Benson Mines, "	Henry Harden	500,000
Bleecker, "	George Shamberger	250,000
Bleecker, "	John M. Peters, Jr.	150,000
Bleecker, "	John M. Peters' Sons	200,000
Bleecker, "	Robert E. Bowler	100,000
Bleecker, "	H. Van Denburgh	700,000
Blue Ridge, "	Henry O'Neil	400,000
Bolton Landing, "	Ward & Roberts	50,000
Carthage, "	Carthage Lumber Company	1,613,311
Carthage, "	Balcom & Spicer	20,000
Canton, "	James Spears*	4,000,000
Canton, "	Canton Lumber Company	6,600,000
Castorland, "	Beaver River Lumber Company	12,000,000
Clinton Mills, "	Ladd & Smallman	300,000
Cranberry Creek, "	L. G. Gifford	40,000
Crary's Mills, "	Oscar Runions	100,000
Diana, "	William Ingraham	25,000
Dickinson Centre, "	B. L. Orcutt	500,000
Elizabethtown, "	Livingston Woodruff	50,000
Ellenburgh, "	John L. Carter	75,000
Ellenburgh, "	F. W. Sherlock	....
Ellenburgh Centre, "	John Houghran	500,000
Forestport, "	Denton & Waterbury	3,500,000
Forestport, "	Forestport Lumber Company	5,976,303
Glens Falls, "	Morgan Lumber Company †	13,135,636

* Mills at Canton and at Buck's Bridge, N. Y.

† Mills at South Glens Falls, N. Y.

LUMBER MANUFACTURED IN YEAR 1897.

HEMLOCK	PINE	HARDWOOD	TOTAL
1,000,000	500,000	....	9,500,000
1,000,000	....	....	1,000,000
100,000	200,000	200,000	1,000,000
....	....	175,000	425,000
50,000	....	50,000	250,000
150,000	....	100,000	450,000
60,000	3,000	10,000	173,000
100,000	....	....	800,000
500,000	25,000	30,000	955,000
30,000	90,000	10,000	180,000
898,014	55,091	6,372	2,572,788
....	....	500,000	520,000
3,000,000	500,000	....	7,500,000
1,650,000	....	....	8,250,000
6,000,000	700,000	....	18,700,000
350,000	....	100,000	750,000
60,000	30,000	*30,000	160,000
200,000	50,000	100,000	450,000
200,000	25,000	100,000	350,000
200,000	....	400,000	1,100,000
175,000	15,000	5,000	245,000
400,000	....	....	475,000
100,000	....	100,000	200,000
40,000	....	15,000	555,000
....	....	100,000	3,600,000
....	....	....	5,976,303
4,077,101	1,572,101	....	18,784,838

* Black Ash.

GREAT FOREST OF NORTHERN NEW YORK.

LOCATION OF MILLS		NAMES OF MANUFACTURERS	SPRUCE
Glens Falls,	N. Y	Finch, Pruyn & Co	18,000,000
Glens Falls,	"	George H. Freeman	1,469,600
Gloversville,	"	W. DeGolyer	200,000
Gloversville,	"	A. T. Peck	275,000
Gouverneur,	"	Frank Starbuck	454,679
Gray,	"	Charles B. Gray	100,000
Gray,	"	William Bennett	300,000
Grove,	"	Helms & Wilson	244,000
Harrisville,	"	C. R. Remington & Sons Co	880,000
Hermon,	"	A. Negus	75,000
Herkimer,	"	C. R. Snell	....
Hinckley,	"	Trenton Falls Lumber Company	2,000,000
Hope Falls,	"	W. H. Lawton	150,000
Indian Lake,	"	William B. Kerst	260,000
Inlet,	"	Fulton Chain Lumber Company	600,000
Inman,	"	M. E. Walker	3,900,000
Jayville,	"	Post & Henderson*	1,500,000
Keene Center,	"	H. C. Nye	300,000
Keene Valley,	"	F. S. Beede	400,000
Knappville,	"	Wheeler Knapp†	100,000
Lake Pleasant,	"	M. B. Hosley	150,000
Lake Pleasant,	"	Asa Aird	200,000
Long Lake,	"	A. W. Shaw	60,000
Long Lake,	"	W. C. Robinson & Brothers	100,000
Luzerne,	"	Frederick C. Hall	50,000
Luzerne,	"	John Shaver	....
Lyonsdale,	"	C. L. J. Ager	100,000

* Office at Oswego, N. Y.

† Mills at Knappville and Dolgeville, N. Y.

LUMBER MANUFACTURED IN YEAR 1897.—*Continued.*

HEMLOCK	PINE	HARDWOOD	TOTAL
1,500,000	300,000	125,000	19,925,000
658,800	234,800	....	2,363,200
75,000	20,000	5,000	300,000
350,000	115,000	50,000	790,000
462,738	83,195	....	1,000,612
50,000	....	500,000	650,000
50,000	....	50,000	400,000
90,000	41,400	6,250	381,650
1,376,000	175,000	275,000	2,706,000
250,000	20,000	....	345,000
250,000	....	500,000	750,000
....	....	....	2,000,000
175,000	....	75,000	400,000
100,000	10,000	10,000	380,000
400,000	50,000	....	1,050,000
....	125,000	300,000	4,325,000
1,300,000	200,000	50,000	3,050,000
50,000	10,000	10,000	370,000
225,000	....	25,000	650,000
25,000	....	175,000	300,000
75,000	4,000	5,000	234,000
200,000	50,000	*90,000	540,000
33,000	18,000	10,000	121,000
73,000	13,000	6,000	192,000
400,000	500,000	200,000	1,150,000
260,000	300,000	....	560,000
300,000	100,000	25,000	525,000

* Includes 40,000 feet of basswood.

GREAT FOREST OF NORTHERN NEW YORK.

LOCATION OF MILLS		NAMES OF MANUFACTURERS	SPRUCE
Lyons Falls,	N. Y	Gould Paper Company	2,432,949
Malone,	"	Miles N. Dawson	156,336
McKeever,	"	Moose River Lumber Company	12,050,000
Middle Sprite,	"	George Shull	100,000
Middle Sprite,	"	Brownell Brothers	125,000
Middle Sprite,	"	John C. Schulenburgh	200,000
Morrisonville,	"	F. M. Purdy	4,000,000
Mountain View,	"	E. R. Bryant	380,000
Natural Bridge,	"	Yousey Brothers	300,000
Natural Bridge,	"	Calvin V. Graves	....
Natural Bridge,	"	Weston, Dean & Aldrich	5,000,000
New Bremen,	"	M. W. Van Amber	1,800,000
Newman,	"	Benjamin T. Brewster	400,000
Newton Falls,	"	Newton Falls Paper Company	50,000
Newton Falls,	"	P. W. Waite	200,000
North Bush,	"	R. E. Holmes	300,000
Northville,	"	John A. Willard	100,000
North Elba,	"	Byron R. Brewster	600,000
Northwood,	"	A. Odit	200,000
Norwood,	"	Norwood Manufacturing Company	12,644,398
Old Forge,	"	Old Forge Company	135,000
Onchiota,	"	Kinsley Lumber Company	1,500,000
Oswegatchie,	"	Andrew Collins	....
Oswegatchie,	"	John Irvin	300,000
Oswegatchie,	"	J. R. Lafave	....
Owl's Head,	"	S. G. Boyce	1,500,000
Parishville,	"	S. L. Clark & Son	2,000,000
Parishville,	"	Parishville Lumber Company	4,000,000

LUMBER MANUFACTURED IN YEAR 1887.—*Continued.*

HEMLOCK	PINE	HARDWOOD	TOTAL
30,000	50,000	....	2,512,949
111,579	....	....	267,915
200,000	3,810,000	40,000	16,100,000
25,000	....	....	125,000
10,000	....	5,000	140,000
25,000	....	25,000	250,000
100,000	300,000	50,000	4,450,000
....	....	40,000	420,000
1,265,000	100,000	*110,000	1,775,000
50,000	25,000	125,000	200,000
8,000,000	1,675,000	100,000	14,775,000
1,200.000	100,000	....	3,100,000
....	....	....	400,000
500,000	....	40,000	590,000
....	....	1,000,000	1,200,000
200,000	....	40,000	540,000
300,000	200,000	100,000	700,000
....	....	....	600,000
....	....	....	200,000
542,700	1,117,446	....	14,304,544
....	135,000	....	270,000
200,000	300,000	250,000	2,250,000
111,493	....	138,066	249,559
250,000	10,000	400,000	960,000
....	... .	†600,000	600,000
....	....	2,000,000	3,500,000
260,000	130,000	30,000	2,420,000
500,000	250,000	....	4,750,000

* Includes 35,000 feet of basswood.

† Birch and maple lumber.

GREAT FOREST OF NORTHERN NEW YORK.

LOCATION OF MILLS		NAMES OF MANUFACTURERS	SPRUCE
Philadelphia,	N. Y	William Roberts	500,000
Pine Lake,	"	Henry T. Bona	175,000
Potsdam,	"	A. Sherman Lumber Company*	6,161,959
Reynoldston,	"	Reynolds Brothers & Co	2,000,000
Rockwood,	"	Levi Stahl & Son	250,000
Rockwood,	"	Everett Young	300,000
St. Regis Falls,	"	Santa Clara Lumber Company	....
Salisbury,	"	James Fuller	25,000
Salisbury Centre,	"	J. F. McDougal	150,000
Sandy Hill,	"	Kenyon Lumber Company	4,943,865
Saranac Inn,	"	Upper Saranac Association	600,000
Saranac Lake,	"	Stephen Merchant	1,000,000
Star Lake,	"	F. J. Redway	230,000
Stony Creek,	"	Lee L. Hall	10,000
Stony Creek,	"	A. D. Scribner	25,000
Stony Creek,	"	Charles Smith	20,000
Stratford,	"	J. C. Livingston & Co	1,800,000
Stratford,	"	C. P. Goodwin	100,000
Stratford,	"	David Helterline	600,000
Thomson,	"	Thomson, Douglas & Dix	1,000,000
Tupper Lake,	"	A. Sherman Lumber Company †	4,843,957
Tupper Lake,	"	Tupper Lake Manufacturing Company ‡	20,000,000
Warrensburgh,	"	A. C. Emerson & Co	180,000
West Stockholm,	"	George N. Gibson & Son	600,000
Wilmurt,	"	Richards Brothers	211,593
Entire District		Small mills	1,500,000
		Total	188,353,586

* Does not include lumber manufactured by this firm, at Tupper Lake.
† Lumber manufactured by this company at Potsdam is reported separately.
‡ Manufactures lumber for various parties.

LUMBER MANUFACTURED IN YEAR 1897.—*Concluded.*

HEMLOCK	PINE	HARDWOOD	TOTAL
2,000,000	300,000	400,000	3,200,000
10,000	....	50,000	235,000
2,026,349	912,076	18,800	9,119,184
1,000,000	....	100,000	3,100,000
400,000	50,000	40,000	740,000
200,000	....	100,000	600,000
....	....	2,500,000	2,500,000
200,000	....	....	225,000
....	....	100,000	250,000
3,013,060	1,946,276	39,039	9,942,240
400,000	400,000	15,000	1,415,000
....	....	....	1,000,000
40,000	10,000	50,000	330,000
80,000	....	400,000	490,000
20,000	....	250,000	295,000
70,000	5,000	*60,000	155,000
....	....	250,000	2,050,000
60,000	80,000	....	240,000
200,000	....	150,000	950,000
750,000	250,000	....	2,000,000
8,244	1,994,670	....	6,846,871
....	5,000,000	....	25,000,000
900,000	285,000	5,000	1,370,000
800,000	50,000	50,000	1,500,000
29,501	....	82,797	323,891
500,000	500,000	500,000	3,000,000
55,656,579	26,120,055	14,777,324	284,907,544

* Basswood.

GREAT FOREST OF NORTHERN NEW YORK.

CONSUMPTION OF PULPWOOD FOR YEAR 1897.

LOCATION OF MILLS		NAME OF MANUFACTURERS	CORDS
Au Sable Chasm,	N. Y......	Alice Falls Company................	5,000
Au Sable Forks,	"	J. & J. Rogers Company	32,931
Brownville,	"	International Paper Co..............	7,000
Brownville,	"	Brownville Paper Company	*1,120
Brownville,	"	Outterson Paper Company...........	225
Ballston,	"	George West	5,000
Black River,	"	The Jefferson Paper Company........	3,000
Black River,	"	Black River Wood Pulp Company	800
Black River,	"	H. Remington & Son P. & P. Co	4,000
Beaver Falls,	"	The J. P. Lewis Company	1,062
Beaver Falls,	"	Lewis, Slocum & LaFevre	1,667
Black River,	"	Empire Wood Pulp Company	126
Benson Mines,	"	Henry Harnden.....................	2,000
Carthage,	"	Maxwell & Yousey	800
Center Falls,	"	Angell & Langdon	500
Chateaugay,	"	Chateaugay Pulp Company	5,000
Chateaugay,	"	High Falls Pulp Company	2,500
Colton,	"	Raquette River Pulp Company	4,000
Dexter,	"	Jones & Hunter....................	800
Dexter,	"	Frontenac Paper Company...........	800
Dexter,	"	Dexter Sulphite Pulp and Paper Co ...	*12,797
Dexter,	"	St. Lawrence Mills	1,000
Easton,	"	American Wood Board Company	1,550
Emeryville,	"	Gouverneur Wood Pulp Company	3,312
Felts Mills,	"	Taggarts Paper Company............	4,802
Forestport,	"	Edward Curran	866

* This Company uses pulpwood from Canada in addition to the wood reported here.

GREAT FORESTS OF NORTHERN NEW YORK.

CONSUMPTION OF PULPWOOD FOR YEAR 1897.

(Continued.)

LOCATION OF MILLS		NAME OF MANUFACTURERS	CORDS
Fullerville,	N. Y	Keller Brothers	1,000
Fulton,	"	Victoria Paper Mills Company	250
Fulton,	"	Oswego Falls Pulp and Paper Company	5,000
Fulton,	"	Fulton Paper Company	2,894
Glens Falls,	"	Glens Fall Paper Mill Company *	9,252
Great Bend,	"	Taggarts Paper Company	1,448
Hinckley,	"	Hinckley Fiber Company	16,000
Lockport,	"	Traders Paper Company	500
Lockport,	"	Lockport Pulp Company	998
Lyons Falls,	"	Herkimer Paper Company	5,738
Lyons Falls,	"	Gould Paper Company	7,545
Mechanicville,	"	The Duncan Company	16,400
Middle Falls,	"	Bennington Falls Pulp Company	325
Newton Falls	"	Newton Falls Paper Company	9,624
Niagara Falls,	"	Niagara Falls Paper Company	†2,080
Norwood,	"	O. E. Martin	1,500
Oswegatchie,	"	Standard Pulp Company	2,000
Palmer,	"	International Paper Company	‡12,215
Piercefield Falls,	"	International Paper Company	14,000
Plattsburgh,	"	Treadwell's Mills Pulp and Paper Co...	6,000
Plattsburgh,	"	Freydenburgh Falls Pulp Company	12,000
Plattsburgh,	"	James H. Allen	2,576
Port Leyden,	"	Johnston & Gibbie	†580
Potsdam,	"	Raquette River Paper Company	7,000
Pyrites,	"	High Falls Sulphite P. and M. Co....	4,937

* Mills at Glens Falls, Fort Edward and Cadyville, N. Y.

† Uses pulpwood from other localities also.

‡ Uses pulpwood from Canada also.

GREAT FOREST OF NORTHERN NEW YORK.

CONSUMPTION OF PULPWOOD FOR YEAR 1897.

(Concluded.)

LOCATION OF MILLS		NAME OF MANUFACTURERS	CORDS
Rochester	N. Y	Genesee Paper Company	3,000
Sandy Hill,	"	Sandy Hill Power Company.........	3,792
South Edwards,	"	South Edwards Pulp Company	2,000
Thomson,	"	Thomson Pulp and Paper Company ...	2,105
Ticonderoga,	"	Lake George Paper Company	2,600
Ticonderoga,	"	E. Richards & Son	1,517
Ticonderoga,	"	International Paper Company	1,100
Ticonderoga,	"	Ticonderoga Pulp and Paper Company.	*11,972
Warrensburgh,	"	Schroon River Pulp Company	3,000
Watertown,	"	Remington Paper Company..........	13,806
Watertown,	"	Knowlton Paper Company...........	616
Watertown,	"	C. R. Remington & Son Company	5,200
Willsboro,	"	New York and Pennsylvania Company.	*7,300
		Total..................	302,528

* Poplar.

GREAT FOREST OF NORTHERN NEW YORK.

MANUFACTURE OF SHINGLES AND LATH FOR YEAR 1897.

LOCATION OF MILLS		NAME OF MANUFACTURERS	SHINGLES	LATH
Beaver River,	N. Y.	F. Ouderkirk	600,000	....
Bleecker,	"	George Shamberger	....	65,000
Bleecker,	"	John M. Peters, Jr.	....	175,000
Bleecker,	"	Robert E. Bowler	....	25,000
Bleecker,	"	H. Van Denburgh	....	300,000
Blue Ridge,	"	Henry O'Neil	800,000	10,000
Canton,	"	James Spears	400,000	500,000
Canton,	"	Canton Lumber Company	....	1,000,000
Clinton Mills,	"	Ladd & Smallman	1,370,000	554,000
Crary's Mills,	"	Oscar Runions	....	100,000
Diana,	"	William Ingraham	500,000	....
Dickinson Center,	"	B. L. Orcutt	1,000,000	....
Elizabethtown,	"	Livingston Woodruff	150,000	30,000
Ellenburgh,	"	F. W. Sherlock	50,000	....
Ellenburgh,	"	John L. Carter	115,000	....
Ellenburgh Center,	"	John Haughran	250,000	....
Forestport,	"	Denton & Waterbury	....	4,500,000
Forestport,	"	Forestport Lumber Company	....	3,828,000
Glens Falls,	"	Finch, Pruyn & Company	....	5,000,000
Glens Falls,	"	George H. Freeman	....	661,750
Glens Falls,	"	Morgan Lumber Company	....	4,078,900
Gloversville,	"	A. T. Peck	....	400,000
Gouverneur,	"	Frank Starbuck	....	279,700
Gray,	"	William Bennett	100,000	30,000
Grove,	"	Helms & Wilson	211,500	....
Harrisville,	"	C. R. Remington & Son Co	....	500,000
Herman,	"	A. Negus	200,000	....

GREAT FOREST OF NORTHERN NEW YORK.

MANUFACTURE OF SHINGLES AND LATH FOR YEAR 1897.

(Continued.)

LOCATION OF MILLS		NAME OF MANUFACTURERS	SHINGLES	LATH
Indian Lake,	N. Y.	William B. Keno	....	75,000
Inlet,	"	Fulton Chain Lumber Company	500,000	....
Inman,	"	M. E. Walker	1,200,000	....
Jayville,	"	Post & Henderson	500,000	250,000
Keene Valley,	"	F. S. Beede	300,000	400,000
Knappville,	"	Wheeler Knapp	100,000	....
Lake Pleasant,	"	M. B. Hosley	....	100,000
Lake Pleasant,	"	Asa Aird	....	200,000
Long Lake,	"	A. W. Shaw	....	200,000
Luzerne,	"	John Shaver	300,000	75,000
McKeever,	"	Moose River Lumber Company	50,000	6,133,000
Morrisonville,	"	F. M. Purdy	4,450,000	600,000
Natural Bridge,	"	Calvin V. Graves	200,000	....
Natural Dam,	"	Weston, Dean & Aldrich	1,840,000	4,000,000
North Bush,	"	R. E. Holmes	....	250,000
North Elba,	"	Byron R. Brewster	200,000	60,000
Norwood,	"	Norwood Manufacturing Company	....	3,000,000
Northville,	"	John A. Willard	....	300,000
Onchiota,	"	Kinsley Lumber Company	300,000	1,000,000
Oswegatchie,	"	John Irvin	200,000	....
Owl's Head,	"	S. G. Boyce	1,300,000	....
Parishville,	"	S. L. Clark & Son	1,000,000	....
Parishville,	"	Parishville Lumber Company	1,000,000	....
Philadelphia,	"	William Roberts	1,498,000	87,400
Pine Lake,	"	Henry T. Bona	....	150,000
Potsdam,	"	A. Sherman Lumber Company	5,415,000	1,979,000
Reynoldston,	"	Reynolds Brothers & Co	500,000	....

GREAT FOREST OF NORTHERN NEW YORK.

MANUFACTURE OF SHINGLES AND LATH FOR YEAR 1897.

(Concluded)

LOCATION OF MILLS		NAME OF MANUFACTURERS	SHINGLES	LATH
Rockwood,	N. Y.	Lewis Stahl & Son	....	100,000
Rockwood,	"	Everett Young	....	300,000
Salisbury,	"	James Fuller	50,000	....
Sandy Hill,	"	Kenyon Lumber Company	....	1,932,600
Saranac Inn,	"	Upper Saranac Association	700,000	45,000
Star Lake,	"	F. J. Redway	30,000	....
Stony Creek,	"	Lee H. Hall	200,000	....
Stratford,	"	David Helterline	300,000	....
Salisbury Center,	"	J. F. McDougal	50,000	....
Saranac Lake,	"	Stephen Merchant	200,000	300,000
Thomson,	"	Thomson, Douglas & Dix	....	1,000,000
Tupper Lake,	"	A. Sherman Lumber Company	....	2,257,500
Tupper Lake,	"	Shepard & Morse Lumber Company	6,233,250	....
Warrensburgh,	"	A. C. Emerson & Co	661,000	579,300
West Stockholm,	"	Geo. N. Gibson & Son	600,000	250,000
		Totals	35,623,750	47,661,150

PRODUCTION OF LUMBER BY DISTRICTS IN 1897.

Glens Falls District,	63,683,928 feet
Clinton and Franklin Counties,	26,307,915 "
St. Lawrence County,	105,740,770 "
Jefferson, Lewis and Oneida Counties	46,238,040 "
Herkimer and Fulton Counties,	42,936,891 "
Total,	284,907,544 feet

SUMMARY.

Spruce,	188,353,586 feet
Hemlock,	55,656,579 "
Pine,	26,120,055 "
Hardwood,	14,777,324 "
Total lumber,	284,907,544 feet
Pulpwood, 302,528 cords, equivalent L. M.,	166,087,872 feet
Total,	450,995,416 feet
Shingles,	35,623,750 Pcs.
Lath,	47,661,150 "

ANNUAL CONSUMPTION OF LOGS AND PULPWOOD, 1890–1897.

	Feet.	Feet.
1890—Saw logs, spruce, hemlock, pine and hardwoods,	325,690,634	
Pulpwood, 94,638 cords,	51,966,262	
		377,656,896
1891—Saw logs,	286,710,593	
Pulpwood, 126,183 cords,	69,274,283	
		355,984,876
1892—Saw logs,	406,954,200	
Pulpwood, 147,392 cords,	80,918,537	
		487,872,737
1893—Saw logs,	355,050,528	
Pulpwood, 167,825 cords,	92,135,707	
		447,186,235
1894—Saw logs,	288,700,269	
Pulpwood, 204,182 cords,	112,095,918	
		400,796,187
1895—Saw logs,	297,610,161	
Pulpwood, 276,669 cords,	151,891,281	
		449,501,442
1896—Saw logs,	270,215,372	
Pulpwood, 291,246 cords,	159,894,054	
		430,109,426
1897—Saw logs,	284,907,544	
Pulpwood, 302,528 cords,	166,087,872	
		450,995,416

In comparing the production of the various years it will be noticed that, in 1891, the amount of logs sawed by the mills was far below that of the preceding or following year. This was due to the dry weather in that season. The freshets or high water in the streams did not last long enough to enable the log drivers to float the usual stock of timber to the mills, a large share of the logs being left along the shores or stranded in long jams on the river bars. In some instances, where the whole drive had reached the mill, there was not enough water to saw the entire stock, the mills being obliged to shut down at times during the summer for lack of power. But in 1892, these logs which had been left along the streams the year before, were driven to the booms in

addition to the regular stock for that year, causing an increased production. By combining the output of the sawmills for 1892 and 1893, it will be seen that the amount sawed was not far from the general average.

The steady increase each year in the consumption of pulpwood is due to the erection of new mills and the increasing demand for woodpulp by the paper manufacturers.

It is interesting to note that the product of the Glens Falls district, which in 1883 amounted to 164,400,000 feet, has fallen to 63,683,928 feet in 1897. This is easily understood when one recalls to mind the large forest areas along the valleys and tributaries of the Hudson, Schroon and Sacandaga Rivers, from which all the spruce, pine, and hemlock has been removed, leaving but a small supply of sawing timber and pulpwood for future operations. In fact, aside from the State Preserve, there are not 80,000 acres of unlumbered forest left on the Hudson watershed.

There has been a notable decrease in the amount of hemlock cut each year. In 1892 there were 96,290,388 feet of hemlock logs sawed in the Adirondack mills; in 1897, there were 55,656,579 feet. This falling off is not due so much to a scarcity of hemlock as to the increasing remoteness of the standing timber, which prevents the lumbermen from hauling the bark to the tanneries or to some point of shipment. The market price of hemlock lumber is very low, owing to the large amount shipped into our State from Pennsylvania; and, unless the land owner can sell his bark to advantage he prefers to let the trees stand. Hence there are large tracts in the Adirondack forests from which all the spruce has been removed, but on which the hemlock is still standing. This is fortunate in one respect; because the cutting of both spruce and hemlock is apt in some localities to thin out the timber too much. The sun and wind being admitted too freely, bad results often follow. This is sure to be the case where the hemlock grows thickly in clumps, a common characteristic of this species, for then denudation ensues. I have noticed several places in our forests where the removal of a thick growth of conifers has left only a thin, sparse stand of hardwoods; and that these hardwoods, especially the birch, declined and died, after which the land became a barren and unsightly waste. This will occur often where the management looks only to the immediate income, with no thought or concern for future revenue.

The amount of hardwood sawed has increased steadily each year from 5,835,844 feet in 1890, to 14,777,324 feet in 1897. This is caused largely by the increased facilities for transportation; but mention should be made also of the great demand for yellow or "red" birch, which was not marketable twenty years ago.

The cutting of hardwood timber in Northern New York will probably increase rapidly. Some mill owners who have exhausted the supply of softwoods on their

lands have commenced sawing hardwood logs in order that their mills and plant may not be idle. They find that they can make this change with profit. A few years ago, before there were any railroads in the Adirondack region, the manufacture of hardwood lumber was confined to some small mills which were scattered at long intervals on the outskirts of the forest. These mills hauled their product in winter to the nearest railway station, generally twenty miles or more. But now there are mills situated at various points along the railroads in the forest, which have not only a short haul for their hardwood logs, but can load the sawed lumber on cars in their mill yard. When the merchantable hardwood trees near the mill have been cut, and the logs can no longer be hauled there with profit, owing to the increasing distance, a portable mill can be set up in the woods wherever the birch and maple are thickest; the logs can be sawed there, piled and seasoned, and the dry lumber hauled on sleighs the next winter to the nearest railway station.

New uses have developed for certain kinds of hardwood, the kinds which predominate in our New York forests. There is now a large demand for birch by the furniture trade. New and better methods have been discovered for finishing this material, with the result that it surpasses all our native woods in the beauty of its appearance and artistic effects. Its light, cheerful color makes it popular, also, for inside finish of houses and business offices, wainscoting, paneling and staircases.

I would also call attention to the great increase in the demand for maple flooring, which is now manufactured in narrow, even widths, tongued and grooved, matched at the ends, and bored by machinery, all ready for laying. The sales of this kind of flooring have increased so rapidly of late that the mills can scarcely supply the demand. Its use is due to the superiority of hardwood floors and the ease with which it is now laid.

There is little increase in the sale of beech, which stands third among our hardwoods in the matter of quantity. Its use seems to be limited principally to the manufacture of tool handles, planes, and agricultural implements, although there are other purposes to which it is adapted. The cherry and ash will always meet with a ready sale as fast as they become accessible. The basswood is being cut wherever it can be hauled to the mill; and the white cedar is sawed into shingles in large quantities.

All this means that the time is near when the different species in our forest, both conifers and broad-leaved trees, will become merchantable timber. This is a most desirable condition, provided the State owns the forest; because under State ownership the cutting would never be allowed to interfere with the preservation of the forest and the exercise of its protective functions. This growing demand for hardwood, the merchantable character of all the species, will increase the revenue-producing capacity

of our woodlands, and enable the State to obtain an annual, permanent revenue without depending on some one species as at present. With the annual cutting limited to the annual increment there would be no diminution in forest area. But if the State does not own the land, each species will be cut merely because there is a sale for it, and denudation will surely ensue. It may be that the owners of private forests may adopt a more conservative system of cutting than that which has prevailed. Some are already restricting their spruce cutting to twelve inches on the stump, the same diameter specified in the State forestry law of 1893*, which the Forest Commission adopted when at one time the sale of spruce stumpage on State land was contemplated, although no sales were ever made under that Act. But with our present market conditions and price of labor, and inability to sell fuel, or convert the waste tops and branches into money, it is doubtful whether any forest tract managed on the European system would yield a permanent revenue of four per cent. on the principal.

At the present time, the spruce, as shown in the foregoing statistics, forms over three-fourths of the timber cut in the forests of Northern New York. Nearly one-half of it is used in making woodpulp. This proportion will increase, and it may be that within a few years the entire cut of spruce will be utilized by the pulp mills; for, already, there is more profit in selling it to the pulp mills than in sawing it into lumber.

The kind of spruce which forms the larger part of the product, both for lumber and pulpwood, is the red spruce (*Picea rubens*, Sarg.). Most of the large trees belong to this species. Until late years the botanists recognized only two kinds, the black and the white spruce, the red being classified as a variation of the black. But now the existence of three separate species is admitted. Prof. Peck, the State Botanist, claims that there is still a fourth species, a dwarf spruce, which is distinct and easily recognized. The black spruce of the Adirondacks grows mostly on low, wet grounds, and seldom attains the height and size of the red. It is cut for lumber and pulpwood as well as the other, there being little difference in its appearance aside from a yellowish tint in the wood. The white spruce is a small tree, which in our State is seldom found outside of Essex county.

In my monograph on the Adirondack Spruce, published by the Forest Commission in 1894, I included the black and red spruce under one species, making no mention of the latter, except in a quotation from Prof. Britton relative to it, and the fact that it had been generally regarded as a variation instead of a distinct species. Owing to the recent classification of the spruces and recognition of the red spruce as a separate species, it would have been better if the title of the book had been, "The Adirondack Red Spruce"; for the statistics and measurements contained in the volume relate almost entirely to that species as classified at present.

* Chapter 332, Laws of 1893, Article VIII, Section 121.

It may be interesting to note here the various species which grow on the Adirondack plateau; also, the native trees in other parts of our State which are not found in the Adirondack forest. In the following list I have arranged the different species according to locality, merchantable qualities, and size, instead of families or any natural system.

ADIRONDACK TREES.

CONIFERS.

Red spruce,	*Picea rubens*, Sarg.
Black spruce,	*Picea Mariana.*
White spruce,	*Picea Canadensis.*
White pine.	*Pinus strobus.*
Norway pine,	*Pinus resinosa.*
Scrub or gray pine,	*Pinus Banksiana.*
Hemlock,	*Tsuga Canadensis.*
Balsam,	*Abies balsamea.*
Tamarack, hackmatac, or larch,	*Larix Americana.*
Arbor-vitæ, or "white cedar,"	*Thuja occidentalis.*

BROAD-LEAVED TREES.

Basswood or linden,	*Tilia Americana.*
Hard or sugar maple,	*Acer saccharinum.*
Soft or red maple,	*Acer rubrum.*
White or water maple,	*Acer dasycarpum.*
Striped maple,	*Acer Pennsylvanicum.*
Staghorn sumach,	*Rhus typhina.*
Black cherry,	*Prunus serotina.*
Red or pin cherry,	*Prunus Pennsylvanica.*
Mountain ash,	*Pyrus sambucifolia.*
Shad bush,	*Amelanchier Canadensis.*
Flowering dogwood,	*Cornus florida.*
White ash,	*Fraxinus Americana.*
Black ash,	*Fraxinus sambucifolia.*
White elm,	*Ulmus Americana.*
Black oak,	*Quercus tinctoria.*
Red oak,	*Quercus rubra.*
Beech,	*Fagus ferruginea.*
Hop hornbeam or "hardhack,"	*Ostrya Virginica.*
Yellow birch,	*Betula lutea.*
Canoe or "white" birch,	*Betula papyracea.*
Black willow,	*Salix nigra.*
Balsam poplar,	*Populus balsamifera.*
Balm of Gilead,*	*Populus candicans* (Var.).
Large toothed poplar,	*Populus grandidentata.*
Quaking Aspen,	*Populus tremuloides.*

* Local; planted originally; then it spread.

TREES OF NEW YORK.

(*Not* found in the Adirondacks.)

Broad-leaved Trees.

Cucumber or magnolia,	*Magnolia acuminata.*
Sweet bay or small magnolia,	*Magnolia glauca.*
Whitewood or tulip tree,	*Liriodendron tulipifera.*
Papaw,	*Asimina triloba.*
American holly,	*Ilex opaca.*
Horse chestnut,	*Aesculus hippocastanum.*
Ash-leaved maple or box elder,*	*Negundo aceroides.*
Coffee tree,	*Gymnocladus dioicus.*
Locust,	*Robinia pseudacacia.*
Honey locust,	*Gleditschia triacanthos.*
Wild plum,	*Prunus nigra.*
Black thorn,	*Crataegus punctata.*
Crab apple,	*Pyrus coronaria.*
Sweet gum,	*Liquidambar styraciflua.*
Hercules club,	*Aralia spinosa.*
Sheep berry or Nanny berry,	*Viburnum Lentago.*
Alternate-leaved dogwood,	*Cornus alternifolia.*
Sour gum or pepperidge,	*Nyssa sylvatica.*
Persimmon,	*Diospyros Virginiana.*
Green ash,	*Fraxinus viridis.*
Red ash,	*Fraxinus pubescens.*
Sassafras,	*Sassafras officinale.*
Red or slippery elm,	*Ulmus fulva.*
Cork elm,	*Ulmus racemosa.*
Judas tree or red bud,	*Cercis Canadensis.*
Nettle tree or hackberry,	*Celtis occidentalis.*
Butternut,†	*Juglans cinerea.*
Black walnut,	*Juglans nigra.*
Sycamore or buttonwood,	*Platanus occidentalis.*
Red mulberry,	*Morus rubra.*
Shell-bark hickory,	*Carya alba.*
King-nut hickory,	*Carya sulcata.*
Mocker nut hickory,	*Carya tomentosa.*
Pig-nut hickory,	*Carya porcina.*
Bitter-nut hickory,	*Carya amara.*
White oak,	*Quercus alba.*
Chestnut oak,	*Quercus prinus.*
Scarlet oak,	*Quercus coccinea.*
Black Jack or barren oak,	*Quercus nigra.*
Pin or swamp Spanish oak,	*Quercus palustris.*

* Some trees of this species planted near Franklin Falls, Franklin county, have grown to be large and vigorous. † A few specimens have been found in the Adirondack forest.

BROAD-LEAVED TREES.—*Continued.*

Burr or over-cup barren oak,	*Quercus macrocarpa.*
Post or box white oak,	*Quercus obtusiloba.*
Swamp white oak,	*Quercus bicolor.*
Willow or peach-leaved oak,	*Quercus Phellos.*
Chestnut,	*Castanea Americana.*
Blue beech or ironwood,	*Carpinus Americana.*
Black or sweet birch,	*Betula lenta.*
River birch,	*Betula nigra.*
White birch,	*Betula alba.*
White willow,	*Salix alba.*
Peach willow,	*Salix amygdaloides.*
Downy or swamp poplar,	*Populus heterophylla.*
Cottonwood or necklace poplar,	*Populus monilifera.*

CONIFERS.

Pitch pine,	*Pinus rigida.*
Jersey pine,	*Pinus inops.*
Yellow pine,	*Pinus mitis.*
Red cedar,	*Juniperus Virginiana.*
White cedar,	*Chamaecyparis sphæroidea.*

It will be noticed that the Adirondack list does not include the common nut-bearing trees. Why these hardy species do not grow on the plateau would be hard to explain. The chestnut grows in profusion, attaining a great size, in the vicinity of Caldwell, on Lake George; but it disappears before reaching the uplands. There are plenty of butternuts around Northville and Wells; but as one climbs the hills toward Lake Pleasant, they are no longer in sight. At rare intervals, I have seen the tree in our North woods, along the Jessup River, for instance, but not often enough to warrant placing it upon the list. I included two of the oaks, because it is claimed that these trees grow in various places on the Adirondack plateau; but I have not observed them, except some inferior specimens in Hamilton county, at Indian and Blue Mountain Lakes. I have seen some large ones in the valley of the Sacandaga, but none of any fair size on the interior uplands of the wilderness.

It is claimed, also, that the black birch, the *Betula lenta*, grows in the Adirondacks; but I have been unable to find it. It may be there. My attention has been called at times by guides and woodsmen to what seemed to be a black birch; but in each case the tree proved to be a yellow or a canoe birch. The young twigs of a yellow birch have the same pleasant, aromatic taste as those of the black. The canoe, or "white" birch when young has a black bark; and even after the tree has attained a height of twenty feet or more, the limbs are black.

I have not noticed any white birch, the *Betula alba*, in our Adirondack forest. The tree known there as the "white birch" is the canoe or paper birch, the *papyracea*. The white birch proper may be growing there, but I have been unable to find one, except on the foot-hills or lower grounds that surround the plateau. I doubt whether this species can be found in Northern New York at an elevation of 1,400 feet.

There is some confusion in the common names given to our Adirondack trees. The term "red birch" means a birch with a reddish wood, and not the red or river birch, the *Betula nigra* of the botanists. The hop hornbeam or ironwood is called "hardhack" in Northern New York, a name which elsewhere belongs to a small plant, the purple *spirea* or steeple bush.

The catalpa, ailanthus, and Lombardy poplar are omitted from the list of trees indigenous to New York, because these species, although quite common, have been introduced here. The catalpa is a native of our Southern States; the ailanthus came from China; and the Lombardy poplar from Italy.

Some of the trees in the list are small, never attaining any great size. Of this class are the mountain ash, striped maple, ironwood, shad, dogwood, holly, sumach, redbud, papaw, pin cherry, sheepberry, blackthorn, and wild plum. Some of these are not generally known as trees; but each species has been found at times to attain a height of twenty to thirty feet, with a single shaft eight to twelve inches in diameter.

The list does not include our fruit trees, the apple, pear, plum and garden cherry, for these are not found in our forests. The wood of these trees, especially the apple, is often used in manufacturing articles for special purposes.

The Catskill forest contains a greater number of species than the Adirondack. The oaks are found there in good size and number, and the nut-bearing trees grow on higher ground than in Northern New York. No lumbering operations are carried on now in the Catskill region. The hemlock was cut off several years ago to supply the tanneries with bark; the pine went for building material long before that. There is some spruce and hemlock left on the mountain slopes of the Lower Catskills, its inaccessibility having been its protection; but, in the main, these forests are composed of deciduous trees.

There are no sawmills except a few small affairs with one upright saw, run by water power from some little mountain stream, which saw a few logs occasionally to supply the needs of neighboring farmers.

In Delaware and Sullivan counties there are several factories for making pyroligneous acid or "wood alcohol." There are also several furniture and chair factories that consume annually a large amount of timber. The best of the hardwoods go to the latter; then the acid factories take the rest, being able to utilize most all the broad-leaved species, the trees being cut into cordwood for this purpose.

There is an extensive hoop pole industry there, also, which is very destructive to the sapling growth, and which gleans the waste land after the other demands have been supplied. And so, although there are no lumbering operations in the Catskills, in the ordinary sense of the term, the work of the forest destruction is being steadily carried on.

In the statistics showing the annual consumption of pulp timber no mention is made of any species except spruce. At the same time, other kinds are used to a limited extent in the manufacture of woodpulp. The balsam is cut in considerable quantity where the stock is to be used in a chemical mill; but this species cannot be used in a mechanical mill—one where the wood is reduced to fibre on grindstones—because the large amount of resinous matter gums up the screens. Hemlock can be used in both the mechanical and chemical process; but the paper made from it has a darker shade, and hence is available in small quantities only. Poplar, which fifteen years ago formed the principal stock of the pulp mills, is now used only in two or three mills of this State. This species is still considered the best for the manufacture of the better grades of paper in which a smooth, calendered surface is necessary, as in magazines or illustrated books.

Of the 298 pulp mills in the United States and Canada, ninety-four, or nearly one-third, are in New York. The Canadian provinces come next with thirty-seven; then Maine and Wisconsin with twenty-nine each; and then Michigan with eleven.

The pulp mills of New York represent an investment of over $20,000,000.00, and furnish employment to ten thousand people. To protect this immense industry, and at the same time provide for a future supply of raw material, is a problem in forestry requiring careful study.

The important relation of the forests to the political economy of the State is not fully understood by our citizens. People think of the Empire State as the one with the greatest population, largest cities, and most wealth; they note its great system of railroads, canals, and inland commerce; they see its farms and factories, its schools, churches, magnificent public buildings, and all the evidences of a most advanced civilization. Few think of its forest resources; and, yet, the statistics furnished here show that its annual production of timber is equal to fully three-fourths of the entire Canadian importation of lumber. The protection and management of this great source of industrial wealth is a question which demands to-day the thoughtful consideration of every citizen.

WILLIAM F. FOX.

A Forest Product.

By WILLIAM F. FOX.

FLAP-JACKS WITH MAPLE SUGAR.

FOREST products are not confined to building material and fuel, but embrace others little thought of in connection with our woodlands. They include, for instance, the sheets from which we read our daily news; the foundation on which our railroads are laid; the tanning material necessary in the manufacture of our shoes; the furniture in our homes; the charcoal in our ranges; and the maple sugar and syrup which, as articles of food, are found on every table in our State.

The forests of our Northern State yields annually over 50,000,000 pounds of sugar and 3,000,000 gallons of syrup; or about seventeen per cent. of the granulated sugar manufactured in the United States. By far the greater part is produced in New England and the Middle States, while a considerable amount is also made in Ohio and Michigan. Vermont leads in this industry, its total product last season amounting to 14,123,921 pounds of sugar and 993,685 gallons of syrup. The industry, though wide-spread, does not include the entire habitat of the maple tree, there being certain climatic conditions which tend to restrict the area in which this sugar can be manufactured.

All our maples yield a sap rich in saccharine matter; but the manufacture of sugar is confined principally to the species known as the hard, rock, or sugar maple (*Acer saccharinum*, Wang). Sugar can be made, and is made in some localities, from both species of soft maple, the red maple (*Acer rubrum*) producing more than the other. For our first knowledge of this product we are indebted to the North American Indians, the same people who gave us corn and tobacco. From the records of the earliest explorers on this continent it appears that the Indians tapped the maples, gathered the sap in rude receptacles, and boiled it. The first white settlers used the same methods, which substantially remain unchanged to-day. The only difference is in the improved utensils and greater cleanliness in connection with every detail of

TAPPING A HARD MAPLE.

MAPLE GROVE NEAR NORWICH, CHENANGO CO., N. Y. PROPERTY OF MR. SETH CHAPIN.

the work. The old method of tapping, that used by the early settlers, was to "box" the tree, or cut with an axe a deep, slanting gash about eight inches long, from the lower end of which the fast exuding sap was conducted by a rudely fashioned spout to a bucket. Or, they would often cut two gashes, not far from the ground, the two sloping inward and downward until they met, at which point a spout was inserted. The spout was generally made from a short piece of "shumake" or elder from which the pith had been removed. There are many people living now who will remember seeing these primitive methods.

But the repeated wounds of the axe often destroyed the trees, and so boring was substituted, after which it was discovered that an augur hole would produce nearly as much sap as the broad cut of the axe. Commencing many years ago with a one and one-half inch augur, the size of the hole has been reduced to that of a three-eighth bit, which has been found to yield the best results. Nor is it necessary to bore to any great depth; from one to two inches is sufficient, as most of the sap rises through the outer ducts. The bore should slant slightly upward, to prevent any accumulation of frozen sap in the night. A tin tube or metallic spout is driven in, on the end of which is hung a bucket to catch the sap. If a wooden spout is used the bucket is usually suspended from a large nail driven in the tree. But it is well to avoid driving a nail into the tree, for it will rust and contaminate the sap.

THE WILLIS SAP SPOUT.*

The first tapping is made breast high, and with each successive year the hole is made lower than that of the previous one. This, however, is not necessary, nor is it always adhered to. Two spouts are often inserted to increase the yield; but in a large sugar bush one is generally used in order to minimize any injury to the tree, the desired amount of sugar being obtained by tapping a greater number of trees.

The trunks are tapped usually on the south or southeast side, along which the sap rises first in the spring; later in the season an opening is made on the north side if the tree is to be tapped again. The largest flow can be obtained by tapping on the side bearing the most branches, or over the largest root.

Some sugar makers bore nearer the ground, believing that the lower the hole the more sap and greater per cent. of sugar. Experiments have been made in tapping at various heights, as far as thirty-eight feet above the ground, and on the main roots fifteen feet from the base, sugar being made from all these tappings.

* Sold by Maurice E. Viele, Albany, N. Y.

Trees should not be tapped until they are thirty years old, at which time they will be over fourteen inches in diameter if grown under favorable circumstances. Sugar can be made from small, young trees, but they yield less sap and are not so able to withstand any injury which might arise from the boring. The richest sap is found nearest the bark, the shallow borings furnishing the whitest sugar. The deeper the bore the smaller percentage of saccharine material and the darker the sugar. Care should be taken in boring to select a spot where the bark is clean and healthy, and to avoid any place where there is the least sign of rot; for any decay in the wood will discolor the sap. One bucket of discolored sap will injure or spoil several barrels of the pure liquid.

The question naturally arises here, one that is often asked, whether this annual tapping for a long term of years does not injure or eventually kill the tree. In reply it may be safely asserted that the present system of tapping, making only one or two shallow holes each year, does no perceptible harm. Of course, it does not benefit the tree, and, to some slight extent, may injure it. But the number of years during which the trees withstand the boring without showing any sign of failure or deterioration, so far exceeds the time in which a large maple can be grown from seed, that any discussion on this point is needless.

In 1791, Dr. Benjamin Rush, of the University of Pennsylvania, wrote a letter to Thomas Jefferson, who was then vice-president of the American Philosophical Society, in which the writer discussed at considerable length the manufacture of maple sugar. He mentions a tree which not only survived, but flourished, after being tapped annually for forty-two successive years. In view of the large incisions used then his statement is worth noting. He attributes the ability of the species to withstand the loss of sap to the fact that the sap is diffused through all parts of the tree, a peculiarity in which it differs materially from most of our native trees. Owing to this peculiarity a hard maple has been known to live three years after it had been "girdled" by an axe for the purpose of killing it. Dr. Franklin B. Hough* mentions a sugar bush which he knew had been tapped annually for seventy years, and was still in good condition. Some of the trees had grown old and died, but as they were replaced by younger ones the grove remained with its productive capacity unimpaired. Professor Charles S. Sargent† states that there are trees in Northern New York "which are known to have yielded sugar every year for a century, and which, while much swollen about the base from repeated wounds, are still vigorous and fruitful." If these trees had been tapped from the beginning in accordance with present methods, it is fair to assume that they would have retained their symmetry as well as their vigor.

* U. S. Department of Agriculture; Report on Forestry; Washington, 1884.

† Silva of North America. Vol. II, p. 99.

WYNKOOP HALLENBECK CRAWFORD CO.

A TYPICAL SUGAR BUSH. (SECOND GROWTH TIMBER.)
IN CHENANGO CO., N. Y. PROPERTY OF MR. SETH CHAPIN.

Where the holes do not exceed three-eighths of an inch in diameter they close in two years, and by the third year are covered by the new growth. Some sugar makers plug the holes with wood or cork; some paint the wood in and around the hole at the close of the season to prevent decay.

The season for sugar making varies with the weather. In Northern New York it begins about March 20 and ends about April 18. It varies greatly with different years according as the spring is early or late. An annual record kept by Mr. Benjamin Davenport, of Lowville, N. Y., extending through a period of twenty-two years, shows a mean duration of twenty-nine days.

Sugar making commenced one year, in 1834, as early as February 22; and in 1836 as late as April 17. In 1834 it ended April 5; but in 1836 it lasted until May 2. The longest run in any year was forty-three days, in 1834; and the shortest was eight days, in 1850. Latitude affects the season, also, the work commencing each year in southern Indiana much earlier than in Canada.

The best weather for tapping is when there are freezing nights and warm, thawing days. The most successful runs are made when the mercury falls to about 15 degrees Fahrenheit in the night, and rises to about 50 degrees in the day. A "sugar snow" seems to be an ever present condition, and the old fashioned frolic of the young people is still a noticeable feature of the work. Bright, warm, still days with frosty nights induce the largest flow of sap. While a still day is usually considered desirable, there are some who claim that a westerly wind is a favorable condition. But with warm, thawing nights, a south wind, or an approaching storm, the flow of sap is said to become scanty or cease altogether.

Though the season lasts about four weeks, there are usually only twelve or fourteen good sap days. If the sap gathering is prolonged until the buds swell, the product is bitter and inferior. There is little or no market for "bud sugar." For this reason care should be used in tapping the red maple, as this species buds and flowers the earliest of all our forest trees.

It is claimed that the alternate freezing and thawing is necessary to sugar making, and that for this reason none is made in warm climates. Still, I remember seeing, in 1864, a sugar bush in operation in Shelby County, Tennessee, although no snow fell there that winter, a thin skim of ice on the Duck River occasionally, in the early morning, being the only indication of freezing weather. For similar reasons, it has been stated, little or no sugar is made in extreme Northern forests—New Brunswick, for instance, where the prolonged steady cold in spring precludes the thawing and freezing deemed necessary to a flow of sap.

Circumscribed thus by climatic conditions, the area of manufacture is much less than that belonging to the geographical distribution of the tree.

While it is easy to understand why the mild weather of early spring should warm the ground and start the flow of sap, it is not so clear as to how the cold nights can possibly assist in such a result. The freezing seems to be incidental, rather than necessary, to the process; especially, as the cold at this season is seldom severe enough to freeze the wood to any depth, or have any effect other than to clog the spouts with frozen sap.

Although the sap rises in our forest trees* at all seasons of the year, except when the wood is chilled by a low temperature, no outward flow of any large amount can be obtained while the trees are in leaf. Maple sap will flow during any warm, thawing day in winter, and Dr. Hough states that he has made sugar in each of the winter months. But trees may be killed by winter tapping, for the bark is liable to loosen through the action of the frost. In a pile of cordwood the sap will exude freely from the ends of the maple sticks under the influence of the sun or warm, spring weather, although the trees may have been cut in fall or midwinter.

Trees differ greatly in the amount of sap which they produce. In favorable weather an average tree will yield from two to three gallons in twenty-four hours. One of ordinary size will discharge during a good season about twenty-five gallons of sap; sometimes more, and sometimes less.

Of course, there are phenomenal trees and phenomenal yields. Many years ago a writer in the Greensburg (Pa.) Gazette stated that by inserting twenty tubes in a hard maple tree he obtained in one day twenty-three and three-quarter gallons of sap; and that thirty-tree pounds of sugar were made from this tree during the season, an amount which would indicate that it yielded over one hundred gallons of sap.† Another record mentions a tree (in Massachusetts), six feet in diameter, which produced a barrel of sap in twenty-four hours; and another which flowed 175 gallons during the season.‡ Another writer tells of a maple which was tapped with ten spouts, from which fifty pounds of sugar were made; but it killed the tree.‖ Dr. Hough, of Lowville, N. Y., kept a record on his own premises from 1877 to 1884, which showed that the trees averaged nineteen gallons each season. This included one poor season, 1883, in which the trees produced only one-fourth their usual amount.

Maples standing on high ground, or uneven, rocky land, or on the hill sides, are generally the best producers. Trees growing near cold springs yield sap in large quantities, which is also rich in sugar of the best quality. Second-growth maple land and young groves are also in good repute among the sugar makers.

* The birch contains more sap than the maple.

† Michaux. North American Sylva. Vol. I, p. 106.

‡ Emerson. Trees and Shrubs of Massachusetts. Vol. II, p. 563.

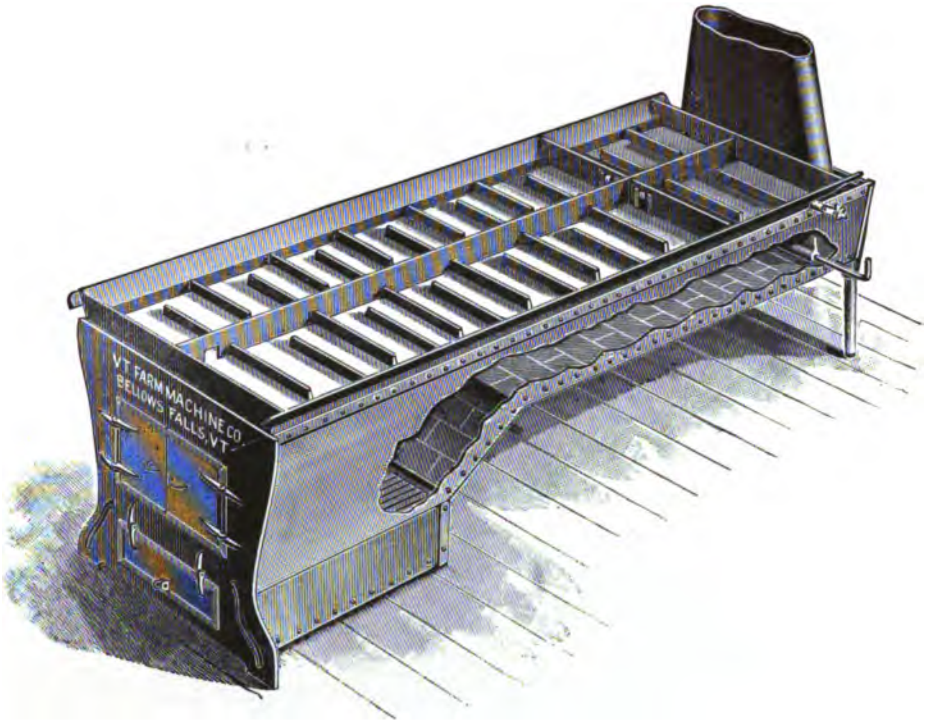
‖ Garden and Forest. Vol. VI, p. 174.

WYNKOOP HALLENBECK CRAWFORD CO.

A SUGAR SNOW.

MAPLE GROVE NEAR NORWICH, CHENANGO CO., N. Y. PROPERTY OF MR. SETH CHAPIN

There is a well established tradition among the farmers that maple sap should not be drank—that it is "very weak'nin." But the men in the sugar camps often drink it, claiming that it is a refreshing beverage. Perhaps the sugar makers originated the story to intimidate the boys who frequent every sugar bush, and evince a troublesome inclination to drink from the sap buckets. The sap from the different trees varies not only in quantity but quality, the product of some trees containing a much greater percentage of sugar than others. Two trees may produce the same amount of sugar, but the product may differ in color or taste. As a general rule it requires four gallons



THE WILLIAMS EVAPORATOR AND ARCH.*

of sap to make a pound of sugar, and thirty-five gallons to make a gallon of syrup. The trees yield on the average about six pounds of sugar per season; but the amount varies greatly with different seasons, running from two to ten pounds per tree. Here, again, any definite statistics as to an average yield are apt to be confused with records relating to some remarkable trees.

From Dr. Rush's letter, previously quoted, we learn that "Samuel Low, Esq., a Justice of Peace, in Montgomery County, in the State of New York, informed Arthur Noble, Esq.,† that he had made twenty pounds and one ounce of sugar,

* Manufactured by the Vermont Farm Machine Company, Bellows Falls, Vt.

† Arthur Noble was the original patentee of the Arthurboro and Nobleboro Patents, now a part of the Forest Preserve.

between the 14th and 23d of April, in the year 1789, from a single tree." Mention has already been made here of a maple that produced thirty-three pounds in one season; also one that flowed 175 gallons of sap, which would indicate a production of forty-three pounds for the season.

In a Vermont sugar bush there is a tree two feet in diameter, with a record of thirty pounds of "small cake" sugar in one season. The sap from this tree was rich in saccharine matter, for it required only seven quarts for a pound of sugar, instead of sixteen quarts, the usual quantity. A sugar maker in Waitsfield, Vt., states that he made twelve pounds from one tree in twenty-four hours; but there were six spouts in this tree. There are, also, various reports of trees that produced fifty pounds in one season, ten or twelve spouts being used on each.

But these are maximum records, and the reader need bear in mind only the two main facts: (1) That four gallons of sap make a pound of sugar. (2) That a sugar bush yields about six pounds per tree in an average season. But this does not apply to maples standing in a primitive forest; for such trees yield far less than the second-growth maples in a farmer's grove or in his fields.

The sap contains about three per cent. of sugar; but the percentage is variable, being somewhat less or more at times and places. Investigations made in 1885 by the Chemical Division of the United States Department of Agriculture furnish a maximum record of 10.20 per cent., obtained from a tree in Vermont during a small flow late in the season; but the same tree averaged only 5.01 per cent. for the entire run that spring. Maples standing in the valleys, on the low, flat lands along the streams, where the soil is dark and moist, will yield plenty of sap, but of inferior quality. Trees thus located produce a smaller amount of sugar in proportion to the sap, and the sugar is darker in color.

The best and lightest colored sugar is made from the sap which flows from the white or sap wood; and the darkest colored product comes from the sap of the duramen or heart wood.* There is a variety of hard maple known as the black maple (*Acer nigrum*) which is in high favor with sugar makers, many of whom assert that its product is far superior in both quantity and quality to that of the regular species.

In the details of sugar making there has been a great advance beyond the simple, primitive methods of earlier years. Then the sap was conducted from the spouts into rude troughs of basswood. These troughs were from two to three feet long, made by splitting the log in halves and hollowing out the flat side. The sap was then gathered in pails and carried to the fire, each man carrying two pails suspended from the ends of a neck yoke fitted to his shoulders. There was seldom any main receptacle for storing the sap, but it was carried to the boiling kettle as fast as it was needed.

* Timothy Wheeler. Garden and Forest. Vol. VI, p. 174.

WYNKOOP HALLENBECK CRAWFORD CO.

UNLOADING SAP AT THE SUGAR HOUSE.

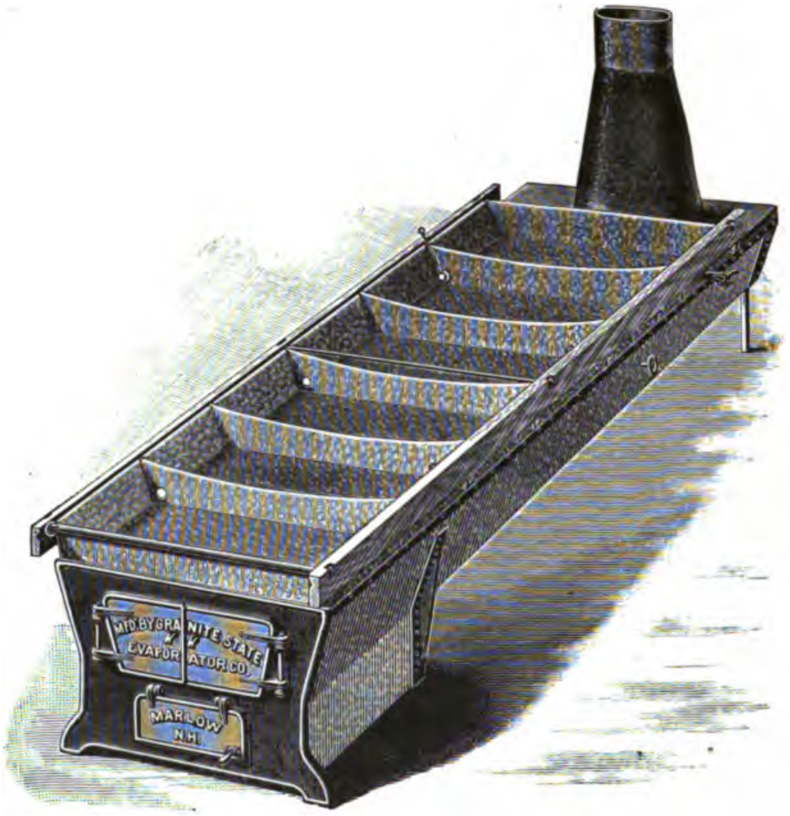
THE SAP RUNS DOWN THE TROUGH INTO A STORAGE TANK INSIDE THE HOUSE.

In boiling the liquid and reducing it to sugar, a large potash kettle was generally used. This was hung on one end of a long pole, to the other end of which weights were attached as a balance, so that the kettle could be easily swung off or on the fire as needed. The fire, kindled with strips of birch bark, was replenished with large sticks or small logs of green wood, that were cut as fast as wanted, few of the sugar makers taking the trouble to provide a stock of dry fuel for the purpose. No shed or house was used, but the work was carried on in the open air, in all kinds of weather, rain or snow, wind or calm, storm or sunshine. Smoke, steam and falling cinders surrounded the boiling kettle, discoloring and flavoring the product accordingly. By constantly adding to the contents of the kettle the sap was boiled from early morning until late at night. The scum and various impurities rising to the surface were skimmed off as fast as they appeared. Small quantities of milk or white of eggs were thrown into the kettle from time to time to clarify the syrup and by coagulation assist in bringing the impurities to the surface, an old fashioned practice still adhered to by many sugar makers. Whenever the liquid was liable to boil over, a lump of fat pork or small piece of lard was thrown in to prevent this. Some sugar makers prevented the overflow by an automatic arrangement which consisted in hanging a piece of pork over the kettle within a few inches of the boiling sap; and some accomplished the same result by greasing the rim of the kettle with lard. The test of granulation was usually made by pouring some of the boiling syrup on the snow. If it "waxed," and on cooling became brittle, the time had come to "sugar off." Sometimes a twig, bent and fastened at the end into a loop, was dipped into the boiling mass; if a film would form across the opening with enough tenacity and elasticity to stretch outward without breaking when blown upon, the test was deemed satisfactory.

But, now, in a large sugar bush, better and more cleanly methods are used; the work is simplified and facilitated by the aid of improved appliances. Pails made of tin or galvanized iron, with covers, manufactured expressly for this industry, are hung on patent, metallic spouts. If a wooden bucket is used the inside is thoroughly painted; for the sap is injured or is liable to sour if it comes in contact with the wood. In gathering the contents of the pails, a team and sleigh are used. In this sleigh is a large tub into which the pails are emptied. At the sugar house or shed there is another and a larger tank, from which the liquid flows into the evaporator or boiling pan. The sap should be thoroughly strained through cloths before boiling; and, so, there should be a strainer on top of the gathering tub in the sleigh, and, also, on top of the storage tank. In the best sugar camps the tubs, whether for carrying or storage, are made of iron lined with white metal. As the sap deteriorates quickly it should be gathered promptly and boiled as soon as possible. If left a few hours fermentation commences, which seriously affects the flavor.

The best evaporator pans, now in use by the large operators, are made of galvanized iron, cold rolled copper, or, in some instances, of heavy tin plates. They are six inches in depth, from thirty to forty inches wide, and from eight to eighteen feet long. The various sizes are made with a corrugated bottom in order to increase the heating surface. The evaporator rests on brick or iron arches, with flues leading from the fire box to the chimney or smokestack. The pan may be made in one piece the entire length, or may include several connected pans. Where a large product is handled, the evaporator is sixteen or eighteen feet long.

At intervals of eight to twelve inches partitions are placed in the pan, which are open at the alternate ends; or, if solid partitions they have holes at either end. The



THE GRANITE STATE EVAPORATOR AND ARCH.*

sap runs from the storage tank into the evaporator at one end through an automatic regulator, and then flows across the pan, backwards and forwards several times, around the end of the partitions, until it reaches the outlet at the finishing end, by which time it is reduced to syrup of the desired density. The regulator, which is connected with the storage tank by a rubber hose, increases or diminishes the inflow of sap according

* Manufactured by the Granite State Evaporator Company, Albany, N. Y.

GRASSE RIVER SUGAR BUSH.

HORSE SHOE FORESTRY CO., HORSE SHOE, ST. LAWRENCE CO., N. Y.

to the heat under the pan; it cuts off the supply entirely when the fire gets low. By this ingenious device there can be no scorching of the contents so long as there is plenty of sap in the storage tank.

The continuous flow of the cold, raw sap into the evaporator keeps the liquid in that end at a much lower temperature than the contents at the further end. As the stream flows from side to side in passing around or through the ends of the numerous partitions the temperature increases, and the crude liquid, by the time it reaches the outlet, is ready to "sugar off." The steaming, boiling fluid is skimmed carefully of the impurities which arise to the surface during its progress through the first compartments, and the shallow stream, with its broad surface exposed to the direct action of a hot fire, evaporates rapidly.

In some evaporators syphons are used to convey the boiling liquid from one pan to the next in order to confine the impurities and scum to the first compartments, where they are most apt to rise to the surface as soon as the sap is heated. But the syphons are unreliable and troublesome to manage, and so are being generally discarded.

The color of the syrup is dependent largely on the depth of sap in the pans, and the length of time that it is exposed to the heated surface of the evaporator. At a depth of half an inch lighter colored syrup can be made than with a depth of one inch.

A thermometer is necessary in the progress of the work. It is placed in the evaporator near the outlet. Granulation is indicated at 238°. At 245° hard cake-sugar is made. At 219° the syrup will weigh eleven pounds to the gallon, and is as heavy as can be made without granulating when cold. Some makers use a saccharometer; but a thermometer is said to furnish the best results.

The syrup contains a mineral substance called "nitre" or "sugar sand," which is a malate of lime. As the season advances there is an increased amount of impurities caused by the swelling of the buds; the greater the quantity of these extraneous substances, the higher the temperature required to make sugar. Syrup weighing eleven pounds to the gallon will yield at 232° about eighty-two per cent. of sugar, or eighty-two pounds to 100 gallons. At 242°, about seventy-eight per cent. will be obtained. The standard of quality as determined by the polariscope is eighty; and to make maple sugar that will stand this test the syrup will have to show a temperature of 233°.

The workman generally determines the proper time to sugar off by putting some of the syrup in a saucer or shallow dish, and stirring it to find out whether it will granulate. The boiling mass is then strained through cloths, and poured into the moulds. The latter are usually brick-shaped, and the cakes weigh from two to four pounds, this shape and these sizes being the most marketable. The utmost care

is necessary in keeping all the utensils clean if a first-class product is to be made. All the pails, tubs, dippers and other implements must be washed often in boiling water.

The modern evaporator is also constructed with a portable iron or steel arch, which can be set up quickly in a sugar house without waiting to lay brick walls or other masonry. Before using it a lining of fire brick is inserted which protects the iron framework and sides from warping or burning out. There are no return flues, and the sheet-iron smokestack rises from the end opposite the fire box. A twelve-foot pan with these improved appliances will evaporate one gallon per minute, and, if necessary, one hundred gallons per hour. After the first hour or so the sap is in the pan not over thirty minutes when it is drawn off. The product of 1,200 trees can be manufactured without working nights.

There is also a great saving in fuel. With an air-tight iron arch, one cord of wood will make about 325 pounds of sugar, which represents a fair day's work of ten

MOULDS FOR MAPLE SUGAR.*

hours. The cost of a galvanized iron portable evaporator, at the factory, varies from $60 to $120, according to the size; if made of tin, from $65 to $130; and if copper, from $85 to $195.

It may be interesting to note here that maple sap may be reduced to sugar by freezing. Dr. Rush, in his letter, states that "this method has been tried for many years by Mr. Obadiah Scott, a farmer in Luzerne county, in this State (Pa.), with great success." The Indians gathered sap, allowed it to freeze and melt repeatedly, whereupon, after throwing away the ice each time, a residuum of syrup and sugar was obtained. When the cold is not intense enough to reduce the sap to the point of granulation, the process can still be completed by boiling.

Sugar can also be obtained from sap by spontaneous evaporation. The hollow stump of a maple tree, cut down in the spring, will often fill with sap which, when evaporated in the sun, will leave a deposit of sugar.

Improved methods have resulted in an improved product which, in turn, has created an increased demand and higher prices. For the better grades the sugar makers receive about ten cents per pound, and about ninety cents per gallon for the

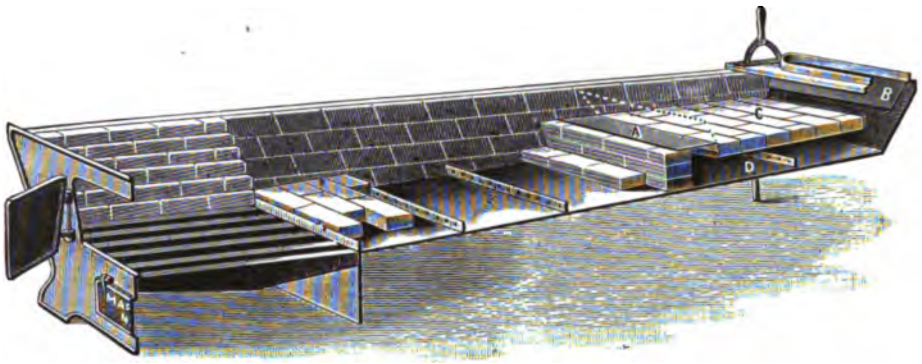
* Made by the Vermont Farm Machine Company, Bellows Falls, Vt.

"WAKE ROBIN" SUGAR BUSH.

HORSE SHOE FORESTRY CO., HORSE SHOE, ST. LAWRENCE CO., N. Y.

syrup, the price varying somewhat with the quality of the article and the condition of the market. Some makers, by supplying families direct with a choice grade, obtain better figures. The prices charged by the retail dealers are necessarily higher than those just quoted.

A bounty on maple sugar was paid by the United States during the years 1892, '93 and '94; after that time payment ceased through a repeal of the bounty law, a statute which included in its provisions all granulated sugars, cane, beet and maple. Under this Act of Congress a bounty of two cents per pound was paid on maple sugar testing 90° by the polariscope, and one and three-quarter cents on that reaching 80°. No bounty was paid on maple sugar or syrup that would not stand the test of 80°. Of the total maple product in the United States, only six per cent. received the bounty. But few, comparatively, of the sugar makers asked for it; the preparation of the



SECTIONAL VIEW OF STEEL ARCH; "GRANITE STATE EVAPORATOR." SHOWING ARRANGEMENT OF GRATE-BARS AND LINING OF FIRE BRICK.

A, damper; B, chimney damper; C, upper flue; D, lower flue.

applications and affidavits, together with the tests and other requirements, offset in most cases the small sum which could be collected, except in case of a large production. For the fiscal year ending June 30, 1893, the general government paid $66,119.32 in bounties on maple sugar, of which amount Vermont received $36,225.23, and New York, which stood second, received $11,703.90. It is interesting to note that, of the applications for bounty, 6,012 came from maple sugar makers, while only 584 came from cane sugar producers, although the latter represented eighty-three per cent. of the total granulated product ot the United States.

The complaint is often heard that maple sugar is adulterated, and that it lacks the true maple flavor of the old fashioned product. The genuine article as now made is so different in color and taste from the product of former years that the consumer is suspicious of its purity. But the "true old fashioned" flavor was too often due to impurities, not purity. The peculiar taste was caused largely by sour sap, burned sugar, smoke, cinders, leaves, bark, and the rain or melted snow that dripped from the

trees into the open tubs and buckets. People acquired a taste for this compound, just as they learned to relish other unwholesome articles of food. On the other hand, the efforts to produce an absolutely pure article has resulted in a whitish, hard, flinty cake in which there is little left of the maple taste.

The refining process may be carried too far. A pure article that is merely sweet will not satisfy the consumer. Cane sugar is equally sweet and costs only half as much. The extra price for maple sugar is paid in order to obtain the delicious flavor peculiar to that product. The work of refining should cease as soon as the impurities are eliminated, in order to retain as far as possible the distinct taste of the maple.

A well managed sugar bush will yield twelve per cent. on the investment. The farmers, who include nearly all our sugar makers, do the work at slight expense, and do it at a season of the year when they have little else to do. Maple groves are no longer cut down for fuel or to clear the land, but are carefully preserved and cultivated. The growth of the young trees and saplings is fostered in order to provide for the future and obtain a maximum production.

While it is conceded that a maple tree in an open field will yield more sugar than one in the forest, it does not follow that a grove, by thinning and trimming extensively, can be made to produce a corresponding quantity. The trees in a grove have sprouted, grown, and thrived under conditions widely different from those surrounding their neighbors in the field. They have been nurtured by the thick deposit of forest humus and decaying leaves, which has also induced a root-growth near the surface where greater moisture and sustenance are found. The roots of the field-maple avoid the sun-dried surfaces, and strike deep down in search of the moisture in the lower strata.

Now, if a maple grove is thinned out and underbrushed too much, the sun dries the soil and the grasses soon appear; the surface becomes dry and hard; the trees fail or die on account of these changed conditions, and from a lack of moisture about their roots. There should be a proper amount of pruning for the removal of dead trees or limbs, and some thinning, necessary in fostering the young growth; but the underbrush should be left to shade the soil, to prevent evaporation, and to furnish the annual mulch of fallen and decaying leaves. It should be remembered that the maple is pre-eminently a shade-enduring species, and that it is unnecessary to cut down trees merely to admit light. Some thinning of the young growth may be advisable wherever it is necessary to relieve the selected saplings from crowded or suppressed conditions; and it is well to cut out the evergreens if there are many of them.

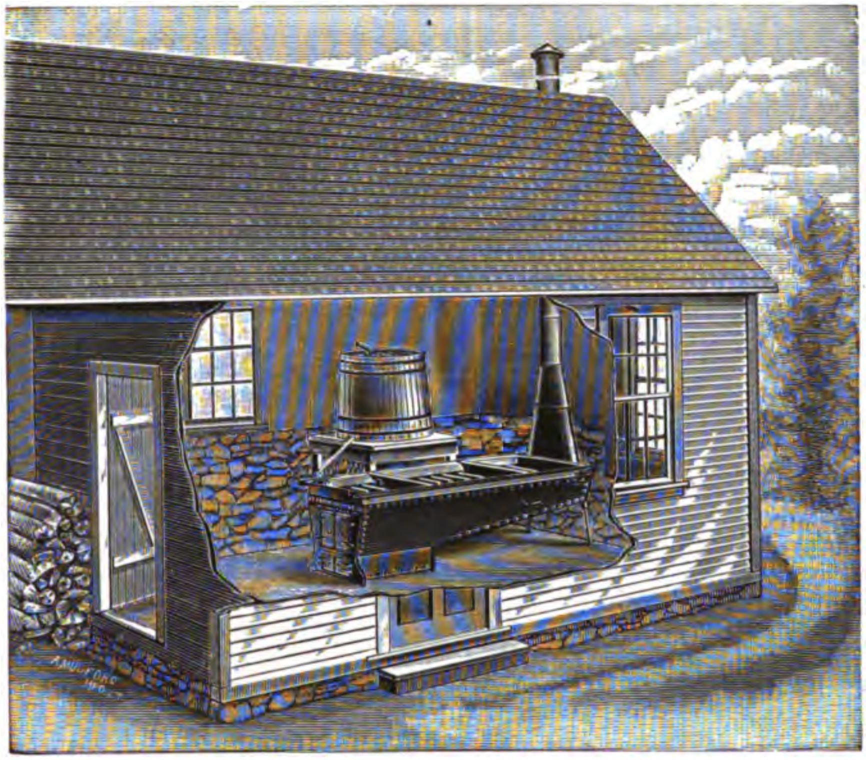
Some of our sugar makers use not only the most improved apparatus and utensils, but erect neat, comfortable houses in which to boil the sap and manufacture their product. In many places the open shed has given way to a neat, well-designed sugar house, built with reference to convenience, cleanliness and economy.

WYNKOOP HALLENBECK CRAWFORD CO.

THE OLD-FASHIONED WAY OF BOILING SAP.

AN ADIRONDACK SUGAR BUSH, HAMILTON CO., N. Y.

In locating a sugar house it is well to place it on sloping ground, so that the sap will run by gravity, from the delivery sleigh to the receiving or storage tank. The house, whether large or small, should be shingled, clapboarded and lined inside and overhead with narrow, matched "ceiling." The floor should be laid with narrow, matched boards, to facilitate scrubbing, and promote that cleanliness which is necessary in handling any article of food. There should be a ventilator shaft over the evaporator, extending through the roof, to permit the free escape of the steam,



INTERIOR OF EVAPORATOR HOUSE.

and with the slats so arranged that, while the steam can escape freely, no rain or snow can enter. There must be enough windows to furnish plenty of light. Dirt and darkness are too apt to accompany each other.

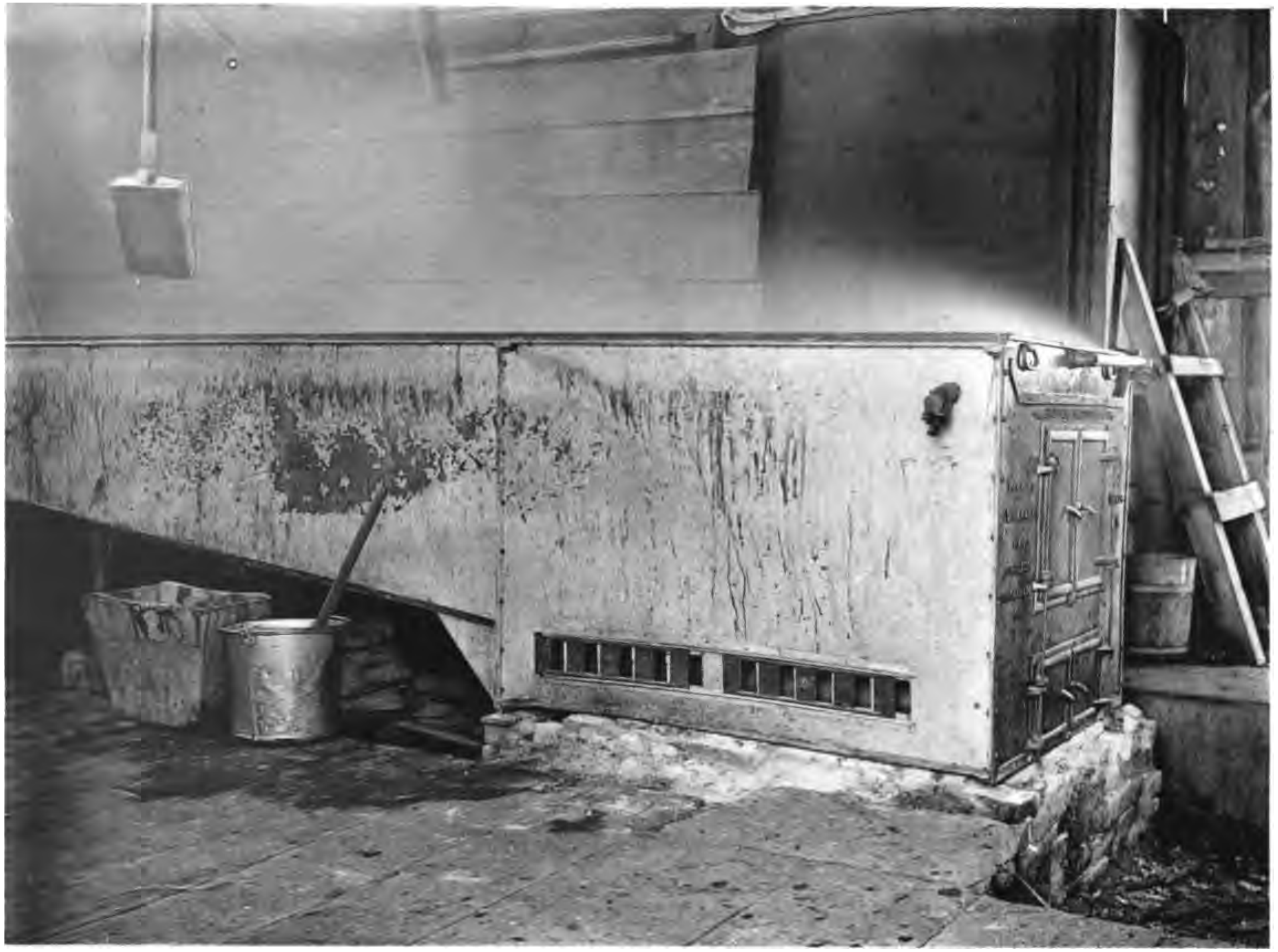
Where a large number of trees are tapped, 1,500 or more, and a large business is carried on, it will pay in the end to have a house with two compartments and a wood-shed. The evaporator room should form the middle compartment. Adjoining it on one end should be the room for sugaring off and preparing the product for the market; on the opposite end should be the woodshed. All three should be under one roof, and in one continuous building of the same width throughout. For the

evaporating room, 12′ x 24′ will be found a convenient size, with a sugaring-off room, 12′ x 12′, and a woodshed of the same dimensions. The latter should be open in front, with a wide sliding door opening into the evaporator room directly in front of the fire arch. With such an arrangement there will be no dust or dirt blowing in from the woodpile. The sugaring-off room should be lined with stout shelves, which will prove convenient in handling or storing the goods. The best place for the receiving tank is on an enclosed or covered platform, built outside the house, in order that the sap may be kept cool. Such a house will prove comfortable, convenient, and can be kept perfectly clean. Its cost ought not to exceed $160.

Life in a sugar bush has its attractions for every lover of the woods. A bright day in early spring revives every energy in man and nature; the pure air and vigorous exercise calls into action each healthful, joyous impulse. The forest is waking from its winter's sleep. The bark of the young poplars, birches and wild cherries—olive green, golden yellow, and copper red—takes on a lively hue from the rising sap. The wasting snow discloses brown spots of earth where among the wet, discolored leaves may be seen the first spring flowers, some of them blooming in all their purity on the edge of a snowbank. The tiny brooks, no longer hidden by the ice, send forth a pleasant murmur.

The surface of the snow is marked with curious little tracks in which are easily recognized the various forms of animal life that people the forest; the eye catches the alert movements of the squirrels as they run swiftly up and down the trees; there is the sound of woodpeckers or the distant drumming of the partridge, while from the leafless branches may be heard the vernal song of the first returning birds. The trees, unclothed by foliage, reveal the graceful arrangement of their limbs; each species is quickly recognized by its distinctive habit of growth; and, in the grand old aisles of gray and lofty trunks, reaching up into vaulted arches of graceful tracery, one is lost in admiration of the details of forest architecture. More than all, there is the restful stillness of the woods, in which as a pleasant contrast is heard at times the woodman's axe and the crackling fires of the sugar maker.

The old-fashioned methods of sugar making are seen no more. But with their disappearance there has gone also the fun and romance which years ago were wont to be associated with these scenes of woodland life. There are many people who treasure in their memories pleasant recollections of youthful hours spent in the sugar camps. They recall to mind its many scenes, the forest at night with its dark shadows that even the firelight did not penetrate; the silhouettes of the men working at the boiling kettles, or the shadowy forms dimly seen moving through the woods from tree to tree; the blackness of the forest overhead, and the whiteness of the snow-covered ground.



WYNKOOP HALLENBECK CRAWFORD CO.

MODERN EVAPORATOR AT WORK.

CHAPIN'S SUGAR HOUSE.

In the early evening, when school was out and the chores all done, the boys and girls would come trooping in from some neighboring farm or village to visit with the sugar makers and have a merry time. Sitting by the fire they told stories and sang their old time songs. There were wrestling matches, and snowballing with the girls, while in some retired spots love making was carried on, and the old, old story was told again. When, with the increasing cold, the sap would no longer run, the buckets were emptied, and everything was made ready to sugar off. The hospitalities of the occasion were observed, and all were invited to eat as much as they pleased. Then, the fires died down, and the tired workmen, accompanied by their visitors, disappeared along the forest paths. The song and laugh and sound of merry voices grew fainter in the distance; the forest was dark and silent again. But long after they were gone the smouldering embers, stirred by the night wind, would at times dispel the shadows with some fitful glow, like gleams of memory lighting up the past.

THE FIRST RUN OF SAP.

Forestry Tracts.

BY WILLIAM F. FOX.


PARTRIDGE FOR SUPPER.

THE State Forestry law, Section 6, Article XII, provides that this Commission "shall take measures for awakening an interest in behalf of forestry, and imparting elementary instruction on such subject"; that it "shall prepare and distribute tracts and circulars of information"; and that "these publications shall be furnished without cost to any citizen of the State on application."

It would be impracticable in these minor publications to discuss the entire subject of forestry. Nor would that be necessary; anyone wanting to pursue this study will have no difficulty in finding text books, written by recognized authorities, in which every branch is treated with exhaustive detail. The tracts issued by the Commission are intended to outline the subject only, and to furnish without expense, in some convenient form, a knowledge of certain elementary principles beyond which the general reader may not care to go.

This series of tracts, which are entitled, "Short Talks on Forestry and Kindred Subjects," embrace the following topics:

1. Forest Preservation in New York.
2. Forestry.
3. Forest Management.
4. Forest Fires.
5. Tree Planting and Pruning.
6. Climatic Influence of Forests.
7. The Farmer's Wood Lot.
8. How Trees Grow.
9. Culture of Nut-bearing Trees.
10. Forestry in Europe.

The first five numbers appear in the following pages of this Report; the others will be printed in the next Report of the Commission. The series will be further extended from time to time by similar publications on other topics related to forestry matters. There may be some who will want to make a more thorough study of forestry than is afforded by these primary leaflets, persons who do not contemplate taking up forestry work or attending any of our forestry schools, but who may want to

SAWING DOWN TREES.

pursue the subject further on account of the interesting reading matter which it supplies. To all such we would recommend the publication entitled "The Forester; A Monthly Magazine Devoted to Arboriculture and Forestry, the Care and Use of Forests and Forest Trees, and Related Subjects." The Forester is the official organ of the American Forestry Association, which, by the way, should receive an application for membership from everyone in the United States and Canada, man or woman, who is at all interested in these matters. The price of The Forester is one dollar a year. Address, No. 117 Corcoran Building, Washington, D. C. Membership in the American Forestry Association costs two dollars a year, including a copy of The Forester. Address, George P. Whittlesey, Secretary, Washington, D. C.

The American Forestry Association was organized in 1882. Since then it has held annual conventions in the principal cities of the United States and Canada, at each of which numerous papers were read and discussed, all of them interesting and valuable contributions to this class of literature. Addresses, also, were made by distinguished citizens, and by persons prominent in the forestry movement, which owes its inception in this country to the earnest, disinterested work of the Association. The proceedings of each annual meeting, together with the papers read on each occasion, have been published by the Association in the form of annual reports. Any forestry library would be incomplete without a set of these reports, and anyone in quest of reading matter will find them interesting and instructive.

The Pennsylvania Forestry Association, also, has for many years published a periodical entitled "Forest Leaves" ($1 per year), which is recommended to all whether a resident of that State or not. Address, Pennsylvania Forestry Association, 25 North Juniper Street, Philadelphia, Pa.

A course of reading on this subject should include, also, the publications of the Forestry Division, United States Department of Agriculture, Washington, D. C., prepared by Dr. B. E. Fernow,* former chief of that division, and by Mr. Gifford Pinchot, Forester, who is now at the head of that bureau. These publications may be obtained on application through the mails, so far as they still may be in print.

In addition to the pamphlets and department bulletins referred to, the following text books are recommended for study or perusal:

"Elements of Forestry." F. B. Hough. Cincinnati, 1882. 12°.
"Outlines of Forestry." E. J. Houston. Philadelphia, 1893. 12°.
"Forest Planting." H. N. Jarchow. New York, 1893. 12°.
"Studies in Forestry." J. Nisbet. Oxford (England), 1894. 8°.
"The Earth as Modified by Human Action." G. P. Marsh. New York, 1874. 8°.
"The Adirondack Spruce." William F. Fox. Albany, 1895. 8°.†

---

* Professor of Forestry, Cornell University. † Out of print.

"Trees and Tree Planting." Gen. J. S. Brisbin, U. S. A. New York, 1888. 12°.

"Trees of Northeastern America." C. S. Newhall. New York, 1890. 8°.

"Trees of the Northern United States." A. C. Apgar. New York, 1892. 12°.

"Trees and Shrubs of Massachusetts." G. B. Emerson. Boston, 1875. 2 vols. 8°.

"Hand-book of Tree-planting." N. H. Egleston. New York, 1888. 12°.

"Tree Pruning." A Des Cars. Translated from the French. Introduction by Charles S. Sargent, Professor of Arboriculture in Harvard College. Published by the Massachusetts Society for the Promotion of Agriculture. Boston, 1894. 12°.

"The White Pine." Gifford Pinchot and H. S. Graves. New York, 1896. 16°.

"The Adirondack Spruce." Gifford Pinchot. New York, 1896. 16°.

"Forestry in Minnesota." S. B. Green. Delano, Minn., 1896. 16°.

"A Year Among the Trees." Wilson Flagg. Boston, 1881. 12°.

"The Story of the Plants." Grant Allen. New York, 1896. 16°.

"The Tree in Religion and Myth." Mrs. J. H. Philpot. London, MacMillan & Co., 1897. 8°.

"Protection of Woodlands." Hermann Fürst, Director of the Bavarian Forest Institute at Aschaffenburg. Translated by John Nisbet. Edinburgh, David Douglas, 1893. 8°.

"Manual of Forestry." W. Schlich. London, 1896. 5 vols. 8°.

"Natural History of Plants." From the German of Anton Kerner von Marilaun, Prof. of Botany in the University of Vienna. Translated by Prof. F. W. Oliver. London, Blackie & Son, 1897. 6 vols., imp. 8°.

"North American Sylva." Michaux and Nuttall. Philadelphia, 1850. 6 vols. 8°.

"The Silva of North America." C. S. Sargent. Boston, 1891–97. 12 vols. F°. (The most comprehensive and valuable work on arboriculture in the English language.)

"Forestry in Europe." Reports from the Consuls of the United States. Washington Government Printing Office, 1887. 8°.

Annual Reports of State Forest Commissions: New York, Maine, New Hampshire, Pennsylvania, Ohio, Michigan, Colorado, Minnesota, California, Kansas, North Carolina and Wisconsin. May be found in the public libraries of our principal cities.

The publications mentioned in the foregoing list will afford ample information on all the details of forestry and matters relating to it. The list, though comprehensive, is not intended to be a complete one. In fact, nine-tenths or more of the books relating to this subject are foreign publications of which no translations have been made.

The tracts, the text of which follows here, will doubtless appear to some of our readers as trite and simple—as a mere repetition of what has already been said in one way or another on the same topics. But they were not written for those who have made a study of forestry. They are for the use of the thousands to whom the subject is new, and whose attention is called to it for the first time. Hence no attempt is made at scientific discussion, or to furnish technical information. If by the perusal of these little pamphlets the people of our State should take an increased interest in the preservation of our forests and their proper management, the object sought for in their preparation will be accomplished.

Short Talks on Forestry and Kindred Subjects.

By WILLIAM F. FOX.

No. I.

Why Our Forests Should be Preserved and Protected.

A SILENT COMPANION.

IN the development of our State the lands fit for farming purposes have all, or nearly all, been placed under cultivation or are held in wood lots as necessary adjuncts to farms. The remaining lands, which by reason of altitude, short season, or poor soil are unfit for cereals, may be maintained under forest cover without detriment to our agricultural resources.

In European countries, with their older civilization and centuries of experience, forest planting has been found necessary. Such work is now carried on there at an immense expenditure of labor and money, but with profit, the woodlands of those countries yielding large revenues, both public and private. How evident it is, then, that in our country, where large areas of forest are still standing, these woodlands should be preserved and protected from further diminution or injury.

On the existence of our forests depends our future timber supply, one of the greatest factors in our national prosperity. The annual value of our forest products far exceeds the combined annual value of our gold, silver, copper, iron, lead, coal and petroleum products. We must go to the forest for the material for our houses and furniture, barns and fences, railroad ties, bridges and cars, wagons and boats, barrels, boxes, baskets and willow ware, tanning material, turpentine and resin, tool handles and agricultural implements, pianos, organs and other musical instruments, and many articles of necessity or comfort. Two-thirds of the people in the United States use wood for fuel. It enters everywhere into our daily needs; even the newspaper we read is printed on wood. The use of wood has been dispensed with for some purposes, other material having proved better. But new uses for wood are continually developing, which, with an increasing population, results in a still increasing demand.

In the manufacture and transportation of our forest products over half a million people in the United States find profitable employment. Shall the source of all this wealth and industry be destroyed, or shall it be preserved? The rapid consumption of our forests by fire and axe makes this question a timely and important one.

There are other important interests dependent upon the existence of our forests. Within their wooded areas are located the vast system of natural reservoirs which furnish the water supply for our rivers and canals, and for the streams that turn the mill wheels throughout our State. Our inland navigation and our manufacturing interests are largely dependent on this water supply.

These forest reservoirs are formed by the cellular structure of the vegetable mold which everywhere covers the earth beneath the trees. For many years, perhaps a century or more, the falling leaves and twigs have accumulated and decayed. These, together with the mossy growths, the fallen limbs and tree trunks, form the humus whose interstices hold vast quantities of water. This natural reservoir, widely extended as the forests which shade and protect it, covers in our State over 9,000 square miles of mountainous or upland territory in the Adirondacks, Catskills and other localities.

In exercising its functions as a reservoir for storing rainfall the forest acts in various ways. The leaves break the force of sudden heavy showers, and hold temporarily a part of the water. The porous soil and beds of moss retain for a time the rainfall, which by gravitation slowly percolates through the soil and reappears in springs and tiny rivulets whose confluence farther on forms the brooks and streams that create our rivers and furnish the water supply without which agriculture would be impossible and our land uninhabitable.

The capacity of the forest humus to store water is further increased by the dense undergrowth, the mass of tangled roots, and the inequalities of surface formed by fallen trees, all of which help to regulate the flow of these reservoirs. In summer the cool, dense shade of the trees prevents evaporation in the upland swamps which form the sources of many of the smaller streams. In spring the shade of the clustered tree trunks and evergreens retards the melting of the snow which has accumulated during the winter, and prevents thereby the sudden and destructive floods which would be caused by the April sun and warm south winds.

But if the grand old forests that clothe the mountain slopes and plateaus are cut away or destroyed by fire what would be the result? The soil on the hillside would become sun dried and hard, while on the steeper slopes the thin covering of the earth would be loosened and washed away by the action of heavy showers, exposing the bare, gray rock. The rainfall and melted snow, no longer retarded in their flow, would run swiftly down the mountain slopes, creating disastrous freshets and floods. The natural reservoirs once destroyed, no water could be stored, and with the summer heat would come protracted drought and low water in the streams. Agriculture and manufacturing would suffer. Navigation would be difficult, not only on account of low water but by reason of the vast quantities of silt and sand which would be washed

LOG HAULING IN THE ADIRONDACKS.

down from bare, eroded hillsides. Even now, the sediment from the denuded uplands fills the river channels to such an extent that the government has to expend thousands of dollars annually for its removal.

There are well attested instances of large springs, situated near the foot of some hill or mountain, which dried up and ceased to flow soon after the removal of neighboring woods, but which, in after years, resumed their flow when the forests were restored.

In our own State there are many streams which in summer contain no water, which then can be crossed dry shod; and yet there are people living who remember the years when these streams never ran dry, and that these water courses never failed until after the forests which protected their headwaters were cut down and the land cleared.

The volume of water in the Upper Hudson has been continually diminishing until it can scarcely supply the Champlain Canal during a dry season. In 1883 all the water in the Hudson at the Glens Falls Feeder was turned into the canal, and then there was barely sufficient water for navigation.

The Mohawk River for many years supplied the Erie Canal with water at Rome; but with the rapid removal of the forests on that watershed it failed to yield a proper supply, whereupon the Black River, which empties into Lake Ontario, was tapped at Forestport, and its entire flow at that point was diverted southward to supply the deficiency.

There are several streams in New York which once furnished abundant water-power for mills that occupied sites upon their banks, but which have decreased so greatly in volume and regular flow that these mills have been abandoned and are falling from decay.

It is not claimed that forests will increase rainfall; but they do conserve moisture and retard evaporation. If they were destroyed the rainfall would probably continue the same, but the flow of the streams would be more irregular. The water would run off quickly instead of slowly as before. Floods would be more frequent and violent, while in turn the droughts would be more prolonged and severe.

Forests exert locally a favorable influence on climatic conditions. They form shelter belts that intercept cold and violent winds, thereby promoting agricultural interests, and modifying rigorous weather. By the transpiration of moisture the trees help to create the humid atmosphere which in turn waters the farm. In many localities the disappearance of the forests has been marked by a failure of fruit and other crops which hitherto were plentiful and unfailing. As a further result, the winters are colder, and the summers are hotter: the changes in temperature are more

abrupt and severe. The duration of the seasons is affected. Spring is later; and in the fall the Indian summer, once a characteristic feature of that season, is no longer known.

The lofty trees and tall forests also withdraw electricity from the clouds, and thus prevent, in a large measure, violent atmospheric disturbances and hailstorms. The long continued observations made in Europe indicate that hailstorms increase in frequency with the disappearance of the woods; and that with the reforesting of these districts the storms become less frequent and cease altogether. It was observed, also, that hailstorms seldom occurred in the vicinity of forests composed entirely of conifers.

Forests exert in many ways a sanitary and healthful influence. They prevent the sudden changes in temperature which are so destructive to both animal and vegetable life. The masses of foliage absorb any miasmatic or noxious vapors that may exist in the air currents that sweep over them. Within the forest the air is free from dust and deleterious particles, its purity forming a natural sanitarium where invalids find rest and invigoration. The balsamic exhalations of the evergreens have a healing influence in pulmonary diseases, and many sufferers find in our Adirondack forests restored health and a new lease of life.

In our Northern woods there are large sanitariums for the relief of people suffering from pulmonary disease or incipient consumption. From the annual reports published by these institutions it appears that about fifty per cent. of the people who go there for treatment are either cured or obtain permanent relief. In view of the terrible scourge known as consumption, and the thousands who suffer and die each year from this disease, how important it is that the great forest sanitarium which Nature has provided should be protected and preserved.

The supply of fish and game depends largely on the preservation of the forests. Not only the fisherman and hunter find the woods necessary to their pleasure, but also the many thousands who, attracted annually by the beautiful scenery of woods and waters, find rest and recreation in its charming woodland homes.

The dire effect of forest destruction is well known. In some countries fertile slopes and plains have been changed to deserts and uninhabitable wastes. In our own land we have ample warning in failing crops, diminished water courses, droughts and calamitous floods that in many instances have ensued as the direct result of deforestation.

The disastrous effects of cutting down forests which clothe and protect mountain slopes are plainly evident in many countries of the Old World. There are instances where a country once noted for the fertility of its lands, and for the thriving, prosperous condition of its people, has become desolate and uninhabited through the

barrenness which resulted directly from the removal of its forests. There are nations whose decadence dates from the destruction of their forests, and the impoverished conditions which followed.

In the State of New York the percentage of land under forest cover has steadily decreased until its area is less than is required for the welfare of the people. The combined woodlands of our State cover about twenty-one per cent. of its entire territory. These woodlands include not only the great forests in the Adirondack and Catskill regions, but also the many small groves and "wood lots" that are scattered throughout the farming districts, some of which are maintained by the farmers in order to obtain their supply of fuel.

It will be interesting to note here the proportion of forest land in European countries, where after many centuries of civilization the people have learned what proportion of their territory should be kept as woodlands in order to attain the greatest prosperity. The percentage of forest lands in each country is as follows:

FOREST AREAS IN EUROPEAN COUNTRIES.

COUNTRY	ACRES	PERCENTAGE OF TOTAL AREAS	ACRES OF FOREST PER CAPITA
Russia,	508,013,110	38.0	6.8
Austria,	48,145,673	31.3	1.3
Germany,	33,355,373	25.6	0.8
Norway,	19,564,501	25.0	13.1
Sweden,	26,225,467	24.2	9.7
Turkey,	31,280,723	24.1	2.1
Italy,	12,709,213	20.0	0.5
Switzerland,	1,940,659	18.8	0.7
France,	23,510,999	17.7	0.6
Spain,	21,328,489	16.3	1.2
Belgium,	873,435	12.0	0.1
Greece,	1,546,307	11.8	1.1
Great Britain,	2,509,479	3.2	0.1
United States,	489,910,000	26.5	6.9
New York,	7,065,000	21.9	1.1

It is generally conceded, as the result of long observation and experience that a country with one-fourth of its area in forests will produce larger crops and have a better climate than if all the land were cleared.

Shall the remainder of our forests be preserved? The answer rests with the coming generation on whom devolves the legislation of the future.

The State should have a definite forest policy, which should include among other things a steady acquisition of land and enlargement of its preserves. The Government would be justified in appropriating money to retain the soil on our mountain slopes, and prevent it from being washed away, as well as in expending money for the removal of this soil and sediment from our river channels. In carrying out this plan, it should adjust its purchases so that it will not encroach upon the rights of individuals or interfere unnecessarily with the great industries which are dependent on the forests for their raw material. There has been thus far, and probably will be for a long time to come, more land offered for sale to the State than it will appropriate money to buy. There is no need of arbitrary measures.

There are large areas of woodlands held by individuals and associations which are preserved and protected as thoroughly as if owned by the State. But when individuals or companies find themselves unable to hold their forests longer, and must sell the property, or cut the timber, then the State should always be in readiness to buy the land, and assume the responsibility for its proper management.

The time is not far distant when the private woodlands will no longer furnish the supplies needed in our great wood-working industries. Then the State, through its wisdom and foresight, will be able not only to preserve and maintain its forests, but to furnish the material which shall contribute to the permanence of these industries, and the prosperity of our people. Such should be, and such is at present, the forest policy of our State.

The reforesting of barren, denuded lands should be encouraged by some partial exemption from taxation. For many years the State has authorized an abatement of taxes for tree planting on highways; and, it receives no taxes from lands in the Forest Preserve. A similar policy might well be adopted for the promotion of forestry interests and extension of woodlands throughout the State. While there may be constitutional reasons which would prevent any entire exemption from taxation, there could be an abatement sufficient to induce land owners to replant their waste tracts, or to refrain from the timber cutting that becomes necessary on account of burdensome taxes.

No. II.

Forestry.

FORESTRY is that business or industry which consists in the maintenance of forests, and the gathering of their products. It is most successful when it yields the largest possible income annually and perpetually.

It is necessary that some part of our State should be kept under forest cover for two reasons:

First: To provide for our present and future supply of wood, which is needed for our comfort and daily wants.

Second: For the protection of certain physical conditions of the earth's surface, on which depends the happiness and prosperity of the people.

The first reason implies skilful forest management; the second calls for forest preservation. If the first requirement is fulfilled, the second will be amply provided for.

Forestry may be described, also, as the management of trees collectively or in masses. Hence forestry includes tree planting at times; but tree planting is not always forestry.

The planting and care of single trees, whether for fruit or shade, is termed *arboriculture*. The propagation and culture of trees in large masses is known as *sylviculture*. The latter forms a part of forestry.

As the products of the forest are indispensable to our comfort and happiness it is necessary that a certain portion of our territory should be set apart for forest culture. In the civilized countries of continental Europe the wooded areas include from seventeen to twenty-nine per cent. of the whole. Now, certain portions of our State are not suitable for agriculture by reason of altitude, climate, mountainous surface, and poor soil. Hence such lands should be utilized in supplying us with wood instead of food. When one considers the many ways in which wood is used the need of forests becomes evident. As there are several million acres of land in our State that are unfit for farms, we should keep them under forest cover, and thus ensure a supply of its products without being obliged to go elsewhere to buy, thereby saving transportation, and, at the same time, maintaining our home industries. Forestry thus becomes an important factor in our political economy.

The State of New York has large forests which should be preserved and managed under some intelligent system. But in order to maintain the proper proportion of woodlands, and utilize the waste lands which are useless for other purposes, it may be necessary, in time, to plant additional forests. Planting has already become necessary in some places to properly reforest burned and denuded areas.

Forestry implies not only forest preservation, but forest revenue also. It means that the forest shall be maintained, and that, at the same time, trees may be cut and converted into money. But this cutting is done under a system which enables the land owner to obtain a yearly, perpetual revenue without diminishing the area of his forests; because the cutting in any one year is not allowed to exceed the annual growth. Hence the yearly revenue may be comparatively small, but it is perpetual.

The question may be asked,—Why is there any need of forestry? Why not let the woods take care of themselves as they have always done? Why not let Nature reforest the denuded or waste lands?

The answer is, that Nature will supply the wants of man much better when assisted or placed under intelligent control. The farmer finds it necessary to assist Nature if he would obtain the best results. Forestry is only another name for farming. The forest will repay cultivation as well as the farm; it will yield crops as well as the fields.

It is conceded that Nature will grow forests unassisted; and that they will exercise their protective functions as to climate, health, and moisture. But our advanced civilization demands a supply of wood, and immense quantities of it. This material is necessary for many of our daily wants; and we need certain kinds of wood much more than others. Unfortunately, Nature takes little heed of our ideas or wants in raising her forests. She furnishes in profusion the species for which we have little need, and yields only a scanty supply of the kinds we want most.

Now, the business of the forester is to so control and regulate the forces of Nature, that, in a growing forest, or in the conversion of one already grown, the product shall conform closely to our needs and demands; and, that worthless and undesirable species shall be gradually removed to make room for the kind the people want. So, through the intelligent, skilful efforts of the forester, a tract of woodlands will furnish a yearly revenue, and, at the same time, will increase in value until it has reached its maximum of production, both in quantity and quality.

While it is highly important that the timber cut and sold each year should be handled according to the most approved, economical methods, it is equally important that certain work should be done, not only to provide for replacing the timber cut, but to replace it in greater quantities and better qualities; to so manage the forest that, while it furnishes an annual revenue, it is constantly increasing in value until it reaches its maximum; until the trees are as large and numerous as the soil will sustain, and of such species as possess the highest marketable value that can be grown with profit on that soil. The wild or natural forest is as different from the cultivated one in valuable species and amount of production as the waste lands of the farmer is from his wheat fields.

AFTER WORKING HOURS. THE BUNK ROOM.

It must be evident that if only the mature trees are cut each year, and, if the cutting is not allowed to exceed the annual increment, that there can be a yearly revenue, small though it may be, and still preserve the forest. It is evident, further, that if there is a continual, well directed effort to increase the young growth, that the owner will have not only his forest, with its annual yield, but, also, an increase in product. To have these three things—the forest, the revenue, and the increase—is the fundamental principle in the management of all government forests.

To obtain this increase in production, in annual revenues, or money value of the property, is the highest aim of the forester. He who succeeds best in accomplishing these ends is the best forester. The true test of forestry is the balance sheet, the amount of continuous annual profit.

Forestry methods, so far as they are applicable to the market conditions of this country, need not conflict with the business of the lumbermen, although they may modify the present system of forest management. The interests of the forester and the lumberman are largely identical. Each, to some extent, is both a lumberman and a forester, and each can learn something of the other.

Trees, like people, grow old and die; they die of old age, disease, insect blight, and windfalls. Is it not well to utilize them before they rot and fall down? When a forest tree has ceased growing it should be converted into money, and its timber used to supply some of the many purposes for which wood is needed. Proper provision should be made for other trees to take its place; for, no matter what system of forestry is adopted, the cutting of the trees should be so distributed or regulated that there will be no diminution of the forest area.

In our American forests the cutting, hitherto, has included not only the mature trees, but the young ones also. Neither has there been any provision for a future growth. The men who owned the land conducted their work so as to get the greatest immediate return of money, preferring present gains to future revenues. They owned the land, wanted money, and had the legal right to manage their property as best suited their needs.

But the State can manage its forests without being obliged to sacrifice future revenues to suit pressing wants. It is obliged to maintain forests for protective purposes, whether they pay or not, and so can be content with the smaller revenues, which have the advantage of permanency. Hence, it is desirable that the State should own large forests; for, we will then have both forest preservation and a permanent timber supply.

Some of the important and interesting results of skilful forestry work may be seen on the coasts of France and Holland where forests have been planted and established on the barren sand dunes. Before these trees were planted the sand was continually

shifting under the influence of the winds, and encroaching steadily on the adjoining farms and woods, covering the grain fields and destroying the woodlands. The difficult task of introducing vegetable growth on the sea sand was overcome by planting species adapted to the conditions. A vast area of barren land was thus covered with a productive forest and the adjoining farms protected. The need of some such work in our own country is evident, especially on portions of the Atlantic coast in Massachusetts and Southern New Jersey.

A vast amount of labor has also been expended in France and Italy, in the Alps and Pyrenees, in reforesting mountain sides which had become entirely bare and denuded of vegetable growth by the torrents which succeeded the removal of the forests that formerly clothed these slopes with a dense mass of trees. An important part of the work consisted in restoring the soil in some places as well as vegetation. The French government has already expended several millions of dollars in this work. From 1860 to 1879 the expenditures for reclaiming waste lands amounted to $9,500,000, and the work has been continued since then at about the same annual cost. This does not include the subsequent expense of reforesting. With such examples in view there should be no need of argument in favor of forest preservation in our country.

Forestry requires a knowledge of various kinds of work, both practical and scientific. It includes:

First: Practical knowledge of the best methods for cutting and transporting the product at the least expense, and without injury to the standing timber or young growth; also, the best means for preventing fires from spreading through the woods, and extinguishing fires when they occur.

Second: Mathematics, surveying and engineering, in order to make proper computations as to tree growth and timber measurements; to lay out boundaries and compute land areas; to construct roads of proper grades and location so that the transportation of the heavy timber product may be effected at the least expense; to plan the structures that may be needed in controlling the flow of mountain streams or aiding the work of reforesting; and to build the tram roads and bridges often used in hauling logs or timber.

Third: Dendrology, or tree botany, a knowledge of which is necessary in the propagation and culture of the young trees that are to supply the place of the ones to be cut. Through a knowledge of this science the forester becomes familiar with the habits of trees, the years in which they will or will not bear seed, the fertilization and rotation of species, the varying power of endurance which the young trees possess for withstanding heat or shade, and other things which enter into his technical work.

Fourth: Chemistry, in order that the forester may know the nutritive elements in the earth or forest humus that conduce to the growth of trees; and, also, the trees that thrive best in certain soils. This science enables him to understand better how trees grow, how they absorb, from the air, earth and water, certain chemical elements which are assimilated and transformed into wood.

Fifth: Geology, from which is acquired a knowledge of the disintegration of rocks, the origin and formation of soil, the presence of minerals, the classification of rocks, the formation and influence of the underlying strata.

Sixth: Meteorology, the science through which is ascertained the relation of forests to atmospheric and climatic conditions, the influence of forests on moisture and evaporation. In the intelligent management of a large forest there are, at properly selected points, stations for making daily meteorological observations, which are compared with similar ones made at points outside the forest.

In Europe there are forestry schools with special courses of study designed to fit young men for the profession of a forester and render them capable of assuming the care and management of large tracts of woodland. They are educated not only in the details necessary to a successful financial management, but also in the technical work requisite in the production or reproduction of forests.

We have at the present time two schools of this kind in the United States—the State College of Forestry, at Cornell University, Ithaca, N. Y., and the Forestry School, at Biltmore, N. C. In some of our colleges, also, there are lectures on forestry and kindred topics, in which the students acquire an elementary knowledge of the subject which, though it may not be of direct practical benefit, forms a desirable part of a liberal education.

In these schools, both at home and abroad, the course of study for the first two years includes the usual studies pursued in what is termed the scientific course in our American colleges, together with French and German, special attention being given to bookkeeping, accounts, mathematics, botany, chemistry, geology, mineralogy and meteorology. The remainder of the course, occupying two years more, is devoted largely to practical and technical work in the forest, the indoor studies being of a class closely connected with the outdoor work.

It is hoped and expected that when our State is ready to withdraw the present constitutional restrictions relating to timber cutting and other forest revenues, that our great woodland areas will be managed under the best approved forestry system; and that the work will be placed in charge of the skilled professional foresters graduated from these technical schools.

No. III.

Forest Management.

IT would be impracticable to discuss here the various details of forest management; nor would a description of such technical work be of any interest to the general reader. But there are certain elementary principles which enter into the various methods, and which may be briefly outlined.

Any plan of forest management necessarily depends on existing conditions, such as the character of the forest itself, whether old or young, good or bad; also, on the market values, cost of labor, and selling price of the product, logs, timber, lumber, pulpwood, bark, railroad ties, fuel, or whatever it may be; and, whether the owner desires the largest immediate return, or is willing to hold his property as an investment from which he may derive a small but perpetual income, equivalent to a fair interest on the principal.

If the forest is to be cut as fast as possible to satisfy some pressing pecuniary needs, to enable the land owner to realize on his property without regard to the future, then the work of management is comparatively simple; for it involves only the most economical methods of cutting and hauling the timber. But if the owner contemplates a future succession of timber crops, if he wishes to treat his property as an investment that will yield a regular interest on the principal, then he must, in addition to economical methods of harvesting, add the technical work of the forester whose working plans make provision not only for future revenues, but, also, for an increase in the productive value of the property. That there can be a continual cutting of the trees, and yet have a permanent forest may seem contradictory to some; but this very thing has been and is being done in European countries. In their forests the matured trees are not left to decay and fall, to be killed by insect, blight or any of the other destructive agencies which are at work in every forest. The people there have learned to harvest the annual product of their woodlands, and still preserve them undiminished in area and unimpaired as to their beneficent and protective functions.

As the forest management of Europe is based on centuries of experience in the propagation and care of woodlands, some information as to the general methods practiced there will be of interest in connection with this subject.

There are three distinct systems of cutting and reproduction which have been used in European forests. The essential principle in each may be briefly stated as follows:

First: Where the forest is fully grown, to harvest the annual growth by selecting the matured trees only, proper provision for the future growth being made by natural seeding, thinning and pruning, and the removal of diseased trees or undesirable species. This system does not necessarily require the removal of all the mature trees,

as it may be necessary often to allow some to remain for seeding purposes or some other function which they may fulfill; and, for technical reasons, it may be necessary to remove, here and there, trees which have not attained their full growth. This method is known as that of "forest selection."

Second: By dividing the forest into a number of blocks corresponding to the number of years required for the trees to attain their full growth, and cutting one of these blocks each year, the land thus denuded being replanted immediately. By this system, the cutting must necessarily correspond in quantity to the annual growth, and in time the forest, under proper management, will attain the maximum of yield. This method is known as that of the "high forest," "compartment," or "rotation."

Third: By use of what is termed the coppice system, in which the woods are composed of species which will sprout or grow from stumps or roots. This method cannot be used in a forest of conifers, as these trees will not sprout from the stump. It is available where the product is needed for charcoal, fuel, fence posts, poles, cooperage, and wood of small dimensions; but it is not adapted to the production of timber, boards and planks. Under this system, the woods deteriorate, and never become a high forest. At times the forests have been managed under some variation of these methods, and in some places the management has been conducted under a combination of all three. But the most successful results have been obtained under the system based on a rotation of cuttings and plantings in fractional blocks.

The old forests of Europe, which have been under careful, systematic culture for a century or more, yield, on an average, a net annual revenue of about $2.50 per acre. There is a small forest in Switzerland which yields $4.90 per acre annually over and above all expenses. The forests of Saxony also produce an annual net revenue of over $4.00 per acre. The private forests show similar results, although, as a whole, they are not so well managed as those belonging to the government or to the communes. As the private forests exceed the others greatly in area, it is fair to assume that in the aggregate they yield a fair interest on the investment, or they would not be maintained as such.

The fact that the European forests, under their conservative management, have proved a good interest-bearing investment, which has resulted in their preservation, has caused a demand from our people that the forests of this country shall be placed under a similar method of treatment, and that our woodlands should be managed in accordance with European methods. But the people of the United States who are demanding "scientific forestry," as they are pleased to term it, ignore the wide difference in our economic conditions. In Europe the forest administration has the advantage of cheap labor and a high market, while with us these conditions are reversed. If this were the only difference, we could adopt the conservative system

demanded and still succeed, because we have superior facilities for doing the mechanical work necessary in handling, hauling and manufacturing the main product. But there are other and more important advantages which the forester abroad has over the American lumberman. In all European forests there is no waste material. Every part of the tree is marketed; in some places even the leaves are gathered into bales and sold. The limbs, tree tops and stumps—every bit of wood to the smallest stick and fagot—are converted into money, the largest part of this material being sold for fuel. Furthermore, every tree belongs to some merchantable species that is convertible into cash at any time; while in our Adirondack forests, over seventy per cent. of the trees, on an average, could not be sold if they were cut; or, if sold, the price would not equal the cost of cutting and transportation.

Now, in order to understand how European forestry methods are so profitable, and why their system has not been introduced in American forests, it is necessary to note how far their income is derived from the sale of lumber, and how much comes from what, in this country, becomes waste and valueless.

Let us take, for example, the forests of Switzerland, which yield annually a net revenue of $4.16 per acre. The total yield from their 1,940,659 acres approximates closely to the following classification: *

PRODUCT.	CUBIC METRES.	FRANCS.
Lumber,	1,115,600	17,849,600
Firewood,	1,673,400	15,478,950
Pasturage, bark, leaves, berries, by-products,	....	6,671,450
		40,000,000

From these statistics it appears that lumber formed only forty per cent. of the product, and that sixty per cent. is represented by merchantable material which in the American forests goes to waste, and must be left on the ground to rot. It will be noticed, also, that over fifty-five per cent. of the money received came from the sale of material other than lumber.

Now it is evident that if our American foresters, or lumbermen as they are called, could sell their waste material—the limbs, tops and defective trees—, if they could obtain for this waste a sum of money exceeding that which they receive for their saw logs, they, too, could develop a model system of conservative management, and undoubtedly would have done so long before this.

Some of the private forests in New York have recently been placed under a system of management which contemplates better and more economical methods than have heretofore prevailed. But these improved methods must be subordinated to the

* United States Consular Reports on Forestry in Europe, Page 221. Washington, D. C., 1887.

PILING LOGS ON A SKIDWAY.

rigid conditions of the market—the cost of labor and the selling price of material. The range of improvement is narrowly circumscribed, and any attempt at theoretical forestry which ignores these conditions must result in pecuniary loss and consequent failure.

Until a market is found for some of the material which now goes to waste, and also for the utilization of species which are now unsalable or inaccessible, the opportunity for improvement will be limited to such work as prices will permit.

There are some ways, however, in which our private land holders can handle their products to better advantage, and improve their forests without incurring much extra expense:

First: When constructing roads, bridges and skidways, merchantable timber should not be used where other kinds can be cut for such purposes.

Second: In the felling of trees and skidding of logs the young growth should be injured as little as possible. The young seedlings of desirable species, hidden in the underbrush, should receive especial care; their growth should be fostered by clearing away the bushes or saplings that shade or repress them.

Third: The cutting of small trees of merchantable species should not be permitted, for their removal will cause a reduction in land values greater than the profit obtained by cutting them. These young trees, if left, will in time furnish a future supply of timber for market purposes.

Fourth: The tree tops and large limbs should be cut or lopped so that they will lie close to the ground, where, by the crushing of successive snowfalls and absorption of moisture, they will soon decay, and thereby lessen the danger or intensity of any fire.

Fifth: Trees standing on very steep slopes should not be cut; for their removal is liable to result in displacement of the soil. Where any species grows in thick clumps, the cutting should be restricted so as to prevent too great a clearing, thereby insuring safety from the injurious effects of sun or wind.

Sixth: To limit the cutting of merchantable species to some fixed diameter, one as large as the taxes and interest on the investment will permit.

Seventh: To prevent any grazing of cattle that may destroy the seedlings upon which the future growth depends.

Eighth: To avoid the removal of the underbrush in a thinly-stocked forest, as the consequent drying of the ground, together with other resulting evils, would make it difficult to establish a young growth.

Ninth: In cutting and thinning with reference to the future species of timber it is well to promote an admixture of conifers and broad-leaved trees. Experience has demonstrated that mixed woods—which in our forests occur naturally—suffer less

from the ravages of insects; for these pests, if they appear, are more apt to confine their work to some one species. The insectivorous birds are more numerous in woods composed partly of deciduous trees than where the trees are all evergreens. A forest of coniferous, resinous trees is much more liable to fire than one in which there is a large proportion of hardwoods. A mixed forest will produce more wood than a pure forest; and, will better meet the varied demands of the market.

Tenth: To place the tract under the charge of a professional forester, who should designate the trees to be cut, and allow none to be removed except the ones he marked for such purpose; and who should be employed to make the "working plans" so necessary in determining the future management of the tract, and the future character of the product.

The question arises here as to how far it would be profitable to limit the cutting in our American forests to mature trees, and to an amount not exceeding the annual growth. This involves the matter of interest, taxes, and yearly cost of maintenance. The experiment has never been fairly made in our forests, and so there can be no satisfactory answer. In the best managed European forests a net revenue of four per cent. is possible only through a sale of the waste product, which is generally equal to fifty per cent. of the entire gross receipts. On the other hand, those forests are worth on the average over one hundred dollars per acre, and yield four per cent. interest on that valuation.

It can hardly be expected that the American forester who is handicapped fifty per cent. by his inability to sell his waste, can compete with European management or achieve the same results. To obtain an income from his forest he may have to content himself with a smaller diameter and more frequent croppings. As to what this diameter should be it is impossible to say. It must be regulated by the pecuniary needs of the forest owner himself. If in urgent and immediate want of money—all that he can realize—he must and will cut his entire forest as fast as he can turn it into cash. If he is a capitalist and in easy circumstances, he may content himself with cutting his spruce and other merchantable species on the basis of a twelve or fourteen-inch diameter on the stump; and, although it has never been practically demonstrated, there is reason to believe that he could, under some such system of management, obtain a satisfactory, permanent rate of interest on his investment. If the European forests, capitalized at $100 per acre, can pay four per cent., our Adirondack forests ought to pay as much on a basis of $10 per acre, even if there is no sale in this country for fuel and by-products.

In 1893 the Legislature of New York enacted a law authorizing the Forest Commission to sell spruce stumpage on the State preserves, and fixed the minimum diameter for such cutting at twelve inches on the stump. Bids were received by the

Commission for the spruce stumpage on large tracts of land; but no contracts were concluded, and no timber was ever sold or cut under this or any other arrangement. The contracts, which were ready at one time for signing, contained stringent regulations providing for the designating and marking of the trees to be cut, together with ample provision in the way of plainly defined rules for the proper construction of roads and the protection of the young growth. A part of the revenue was to have been expended on forest improvement under the direction of skilled professional foresters. Although this work was never inaugurated, the system thus contemplated would probably form a good basis for the management of private forests. In fact, some large tracts in the Adirondacks are now being administered under these same conditions, and with the same limit of diameter.

The ideal method, however, would be to cut only the matured trees, or such as may have attained a diameter beyond which the future growth would not exceed the interest on the present value. The cutting would not necessarily be limited to the matured trees; neither would it always include them. In the course of his work, the forester would often find it advisable to cut others for technical reasons, their removal being necessary to the improvement of the forest and increase in future yield; and, in places, it might be found necessary to allow some large trees to remain for protective purposes, or to facilitate the work of seeding and reproduction.

In discussing this question of diameter, it is necessary to always bear in mind that while the diameter increases in an arithmetical progression the contents of the tree increase in a geometrical ratio. For instance, a sixteen-foot log, twelve inches in diameter, contains 64 feet board measure; but if it is sixteen inches in diameter it contains 144 feet, or more than twice as much as the other. A twelve-inch tree will yield nine-inch boards only; if we need wide boards or joists we must have larger logs. On the other hand, twelve-inch spruces make good pulpwood; there will be more trees to the acre, and they can be cropped oftener. Small diameters are not incompatible with systematic management. In our Catskill forests there are tracts used for raising hoop poles. The trees are mere saplings; but as the land is cheap the business is profitable, and the croppings though small in bulk are frequent. It is, simply, one form of the coppice system. If a forest is cropped on a twelve-inch basis the owner will have, as a result, a forest of twelve-inch trees; if on a sixteen-inch basis, he will have one of sixteen-inch trees, and so on; the larger the diameter, the larger and more valuable will be the product.

Under our present market conditions, it is not certain that the high forest system of European management would yield a fair interest on the investment. The time may come when such a system will pay in this country; but the forest owners in America will be apt to adjust their business to the present instead of the

possible future conditions of the market, and await the result of the forestry experiments recently instituted in various places.

Our State forests, however, afford a grand opportunity for the safe introduction of European methods of management. The pecuniary requirements which must always govern the business methods of the citizen do not exist there in the same degree. The State must maintain its forests on account of the protective functions which they exercise, whether they yield a revenue or not. But, notwithstanding our present market conditions, our public forests can be made to yield large receipts, even if the rate of interest is not an inducement. Our vast forests may be made a source of public revenue without advancing a dollar for the work.

Beginning in a small way by selling to the highest bidder matured trees properly designated and marked by a professional forester, a fund could be acquired at the start which would furnish a working capital sufficient for the inauguration of the plan. It is not necessary that the State should go into the lumber business, own horses, sleighs and other equipments, hire men, build logging camps, run a boarding house and build roads. The lumberman or jobber to whom the marked trees are sold would do all this. Owing to the strict requirements of the forester, and the many restrictions necessary in a conservative management, the bidders for the timber would probably not pay as much as they do now for their logs under the present easy methods of lumbering; but they would pay something, and it would all be a net revenue. From the receipts thus obtained a part could be turned over annually to the State Treasurer, leaving the remainder to constitute a special fund for paying the foresters, and to provide for the technical work of forest improvement, thinning, pruning, seeding, planting or whatever operations might be necessary in providing for the future growth and increased productivity of the forest. Owing to the forestry clause in our State Constitution no system of management can be undertaken on our public woodlands which will involve the cutting or removal of any timber; but in time this restriction will be removed, and then the test can be made as to how far the State forests, a large part of which have been untouched by the axe, can be made to furnish a permanent revenue, and do it without having to make appropriations to carry on the work.

At present the management of the New York State forests is confined to the work of protection from fire and illegal timber cutting. Some further work might be done in the way of reforesting the burned and denuded tracts, provided appropriations are made by the Legislature for such purpose. In the meantime, while waiting for the present constitutional restrictions on forest cutting to expire by limitation, the acquisition of forest land by the State should continue until the entire Adirondack forest is converted into one solid preserve, and made ready for the skilful and conservative management which, in time, will surely be inaugurated.

No. IV.

Forest Fires.

THE greatest source of danger which imperils the existence of American forests arises from the widespread sweeping fires that hitherto have annually destroyed immense areas of valuable standing timber. In the census year of 1880, carefully gathered statistics showed that the combined areas of woodlands which were burned over in the United States amounted to 10,274,089 acres, and that the value of the property thus destroyed was $25,462,220. These figures were not based on hasty or careless estimates, but on information furnished in reply to circulars sent to every town in the United States, the statistics thus obtained being tabulated by towns, counties and States. From the careful study of the subject there is reason to believe that these figures do not exaggerate the loss. In addition, there was also the immense amount of damage inflicted on the Canadian forests from the same cause, the fires in those woods being proportionately destructive. Persons competent to judge have estimated that in Canada more pine timber has been destroyed by fire than has been cut by the lumbermen.

Nor was this census year of 1880 marked by any unusual prevalence of this scourge. The great forest fires which have become historic events occurred in other years.

In 1825 a memorable fire spread over a large part of New Brunswick and a part of Maine. It occurred in the first week of October, after a prolonged period of heat and drought. The burned territory was about one hundred miles long and sixty miles wide, including over 3,800,000 acres, an area as large as the State of Connecticut. There were 160 persons who were burned to death or drowned in streams, whither they had fled to escape the flames. The loss of standing timber was estimated at £500,000, and the loss in buildings, crops and personal property was officially appraised at £227,713.

The great fire in Wisconsin occurred in October, 1871. The burned territory, which was in the vicinity of Green Bay, included over 250,000 acres. Several villages were destroyed. One of them, Peshtigo, contained over 2,000 inhabitants, one-third of whom perished in the flames or were suffocated by smoke. Over one thousand people lost their lives, while thousands of others were left in destitution and mourning. The loss of timber and property exceeded $30,000,000 in value.

The great Michigan fire occurred in 1881, in the month of September. The most of the burned district was on the peninsula situated between Lake Huron and Saginaw Bay, including a tract of timber land partially cleared and settled, about sixty miles

long and from ten to thirty miles wide, with an area of about one million acres. There were 138 people who lost their lives, and the property destroyed was valued at over two million dollars. Forests, farming crops, orchards, dwellings, barns, cattle and horses were all destroyed in the sea of flame that swept over the land. At night the sky for many miles was red with the glare of the burning forests, while in the daytime the sun was obscured by the dense clouds of smoke. On Lake Huron the air was darkened as with a thick fog. The hot blasts were plainly felt by the people on vessels near the shore, and showers of burning cinders fell on the decks of passing steamers.

In 1894 similar scenes occurred in Northern Minnesota, in the Duluth region. On September 1, of that year, a whirlwind of fire devastated a forest area twenty-six miles in length and from five to fifteen miles in width, destroying in its course the village of Hinckley, where, together with people in the surrounding country, 418 persons met a terrible death. In this same year, in July, the Wisconsin forests were again devastated by a large fire, in which thirteen lives were lost in the village of Phillips, and an immense area of valuable pine timber was destroyed.

While the States mentioned have suffered more from forest fires than others, nearly every State in the Union has its story of annual losses from this source. In our own State destructive fires were of yearly occurrence until the organization of the Forestry Department in the government, the administration of which has succeeded in checking and well nigh suppressing this source of destruction to our woodlands. The widespread devastation, once so prevalent in our Adirondack and Catskill forests, is now largely a thing of the past—the fires now being comparatively few in number and small in area, or limited to barren tracts that have been burned over before. Fires in the timber forests of our State are now rare, and nearly all that occur are in the scattered woodlands in the vicinity of farming districts.

The damage from forest fires, unfortunately, is not limited to the actual loss of timber, but involves, also, the prevention of future growth by the overheating and burning of the soil itself. The vegetable humus, so essential to tree growth, is destroyed, and with it the seeds and seedlings necessary for another forest. If the ground is not burned too much, an inferior growth may follow composed of poplar and small cherry, which in time enriches the soil with falling leaves sufficiently to nourish a succession of more valuable timber.

But in a region where fires are allowed to run unchecked, and no systematic effort is made by the government to prevent their occurrence, there are apt to be second fires which burn over the same ground, and complete the work of destruction. Not only a second but a third burning frequently occurs, rendering the earth completely barren, and leaving an expanse of sterile plains on which there is nothing but sand or rocks.

In most parts of the United States, if the soil is not burned so deeply as to prevent future tree growth, the fires result in a change of forest composition, the succeeding growth being composed of species differing greatly from that of the original woods; but in New York, the poplar, pin cherry, and canoe birch, which invariably succeed a single burning, are followed by the spruce, which is one of the most prominent and valuable species in our primitive forests. This is a favorable condition, for the spruce is a merchantable tree. Its reappearance under such unfavorable conditions is due to its remarkable power of reproduction.

Fires occur more often and spread more rapidly in forests composed of coniferous trees than in woods composed of deciduous ones. Conifers, which include all our evergreen species, are all more or less resinous, ignite easily, and make an intense heat. It is for this reason that the fires in the pineries of the Northwest are so much more extensive and destructive than those in the Adirondacks and Catskills, where over seventy per cent. of the forests are hardwoods.

The causes from which forest fires originate are as follows:

First: Clearing land. More than one-half of the forest fires in New York—and elsewhere as well—originate in the fires started by the farmers on their own grounds for the purpose of burning the brush, log heaps, or stumps in some fallow. Through carelessness or lack of persons on watch, the fire escapes into some adjoining woods, and a general conflagration ensues. Many farmers, in order to get a clean burn, wait for a dry time; some, through thoughtlessness, will start their fallow fires on a windy day. At times, when a brush fire is kindled on a still summer morning, a strong wind may arise during the day which will drive the flames into the adjoining timber, if not properly taken care of. These brush fires have proved such a prolific source of evil that, in New York, a provision has been inserted in the forestry law forbidding the kindling of any fallow fires in the woodland towns except in winter, and in the summer months during which the trees are in full leaf. The farmers, through their carelessness in this respect, have destroyed more forests than the lumbermen in the course of their work. Mention should be made here, also, of fires set intentionally to improve pasturage in open woods, it being done mostly by people who do not own the land which they thus burn over.

Second: Abandoned camp-fires. The persons who are responsible for damage from this cause include hunters, fishermen, travelers, surveyors and other persons journeying through the woods or camping there. A camp-fire is too often left burning after parties have left the ground and resumed their journey. A rising wind fans the smoldering embers into life, sending the fire along some connecting mass of dead leaves until it reaches a dry and fallen tree top, heap of brush, or group of resinous young evergreens. Then in a few minutes the forest becomes a roaring mass of

flame. Sometimes, an abandoned camp-fire which showed little signs of life will burrow in the "duff" or thick layer of needles that fall from the pines and spruces, where it will smoulder for days, burrowing a long distance until it breaks out at some favorable point in flame. These smouldering fires in the duff are exceedingly difficult to extinguish, and have been known to burn even after a long rain, or when covered with a heavy fall of snow. In traveling through the Adirondack lakes the best watch-points on which to stand and wait for a deer to enter the water can be distinguished at a glance by the peculiar light green foliage of the poplars, which succeed the fire that invariably occurs on these watchpoints by reason of the hunter hurriedly leaving his place and jumping into his boat in order to follow some deer that is swimming in the lake. In the meantime, the little fire which he had built to warm himself is left burning, and, being left unwatched, spreads through the surrounding timber. The whole story is told in after years by the grove of poplar trees which replaced the original growth that was thus burned.

Third: Locomotives. Railroads which run through wooded tracts are a frequent cause of fire on account of the sparks and live coals thrown from the smokestacks of the locomotives. The railroad officials endeavor to remedy this evil, because the law makes the company liable for damages from this source. Various devices have been used to prevent the escape of sparks and coals from the stack; but complete success in this respect has not been accomplished, because any screen that would effectually prevent the escape of sparks would interfere more or less with the draught and the capacity to make steam. The danger from this source, however, can be minimized by watchfulness on the part of the trackmen, and by keeping the ground by the side of the railroad entirely free from dry grass, weeds, old, rotten ties, and combustible material. On some railroads the ground each side of the road-bed is thoroughly plowed until nothing but fresh earth is exposed. But even then the right of way is so narrow that the sparks are very liable to be blown into the woods. Forest fires along railroads have also started from heaps of worn-out railroad ties which were being burned in order to get rid of them. Fires have also been caused by dumping the ashpan of the locomotive while going through the woods—a careless act for which there is no excuse. If a railroad runs through a forest for a long distance, as in the Adirondacks, the ashpan should be dumped while going through a cut, so that the loose coals will remain in the ditch next the rails. If dumped while on an embankment, the live coals roll down its side into the bushes and become more dangerous. It is hoped in the interest of forest preservation, that the time is not far distant when the railroads in our forests will be equipped with electric motive power, which will thus eliminate one of the sources of danger to our woodlands.

THE NOON HOUR AT CAMP.

Fourth: Tobacco smokers. The fires that have been traced to this source are more numerous and destructive than would appear at first thought. A pipe or cigar in the woods seems a simple, harmless thing; but they have caused the destruction of timber worth many thousands of dollars, and devastated many thousands of acres. The hot ashes from a pipe falling among dry leaves, or a lighted cigar stub thrown from a wagon into the dry grasses by the side of a woodland road, have been known repeatedly to start destructive fires that sprang up after the careless smoker had gone on his way. Then, again, the man who smokes tobacco is frequently lighting matches and throwing them away. Too often he neglects to extinguish the match, and, after lighting his pipe or cigar, throws it aside while it is still burning, without taking any heed whatever where it may fall. Many of our Adirondack fires that started at some roadside in the woods were caused by just such carelessness, as was disclosed later by the evidence gathered in the case.

Fifth: Berry pickers. This cause is a local one, and is confined to certain States; but it has been, and continues to be a source of damage in New York, especially in the Catskill counties. At intervals of a few years the berry pickers set fire to the low growth of ferns, grasses and bushes that cover the barrens, in order to increase the yield of berries. These tracts have already been converted into barrens by former fires, and hence, as a general thing, the damage is merely nominal, no timber being destroyed. But these repeated burnings preclude all possibility of reforesting these areas, either naturally or otherwise. At times the fires include in their course some batches of inferior second-growth trees which, having escaped for several years, had attained a moderate-sized growth; and then, again, the flames are occasionally blown into some timber lots where a positive loss occurs. It is exceedingly difficult to repress these fires, because the persons who start them have no difficulty in doing so unseen and undetected. Neither will the people who live in the immediate vicinity make any effort to extinguish these fires, the practice having their approval to a large extent. With this class may be included, also, the hunter who burns over an old lumber slash to make a better feeding ground for deer.

Sixth: Incendiaries. Several destructive fires have occurred in the Adirondack forests from this source. The timber thieves who at one time committed extensive depredations on State lands, often set fire to their slashings to conceal the evidence of their crime or to render more difficult any attempt to obtain the evidence necessary to convict them. Fires started for such reasons are now rare in New York; for the activity of the State foresters has rendered timber stealing almost impossible, and so, with the suppression of this evil, there is no longer any inducement to resort to this practice. There are still occasional instances in which some man, inflamed with drink or a desire for revenge, or natural inclination to mischief, will set fire to the woods,

knowing that in the solitude of the wilderness the act can be committed with comparative safety from detection.

Seventh: Carelessness. Under this head may be included the many and various acts resulting from thoughtlessness or stupidity. For instance—the man who sets fire to an old, abandoned lumber camp for the fun of seeing it burn; the man who starts an insect smudge on the slightest provocation and leaves it burning without a thought as to the result; the bee hunter who smokes out the wild bees from their hive in the hollow tree; the summer youth who lights the curly bark on an old birch to see the display of fireworks; and the children who are always ready to play with matches and kindle a fire outdoors.

Eighth: Natural causes. Forest fires from this source are extremely rare, and hardly worth mentioning. There are a few well attested cases of fires caused by lightning, but as they are always accompanied by rain the loss from such cause is merely nominal. There are theories of fires from spontaneous combustion, or ignition of wood by friction of dry limbs, all of which make interesting reading, but are of little value as a matter of fact.

It has been remarked that if you want to preserve the forests you must keep the white man out. It is a noticeable fact in the New England and Middle States that burned areas are all, or nearly all, in the vicinity of roads, settlements, or farms. A highway running through the forest on which there is much travel and carting, is almost sure to be bordered with burned, denuded areas. The tracts of forest in Northern New York where no fire has ever occurred are the ones without roads, except those used by lumbermen in their logging operations. The lumbermen cause no fires, despite the common impression to the contrary. During the winter, the time when they are in camp, the snow prevents forest fires; and in the spring, the time when the ground is covered with dry, dead leaves, the period when most of the fires occur in our State, the lumber crews have finished their work, have left their camp, and are away on the log drives. The farmer, hunter, fisherman and summer camper are the men who burn our woods. Our forests will not be entirely free from fire until the management has been so perfected that each person who enters the woods is placed under strict surveillance as to the use of fire.

All the fires in New York occur either in the spring, during the period extending from the melting of the snow to the time when the trees and underbrush are in full leaf, or in the fall, between the shedding of the leaves and the first snow. These periods of danger vary with the season and locality—our first spring fires occurring in April, as regards the Long Island and Catskill forests; and in May, in the Adirondacks. The fall does not appear to be so dangerous a season in New York as the spring—the autumn fires being less frequent and destructive. Occasionally, in a very dry season,

a fire will occur while the trees are in leaf, destroying both deciduous and evergreen species. Forest fires may be classified in two kinds—ground fires and top fires. The former, which is the most common in New York, is seldom very destructive. It creeps along the ground, flashing through the dry leaves on the surface, igniting old stumps and logs, burning the small underbrush, and traveling slowly unless driven by a high wind. Sometimes a ground fire will burn over an open field if the grass is dry, making a volume of smoke greatly disproportionate to the amount of flame or damage. Ground fires are easily controlled and extinguished if attended to promptly, although the smoke, at times, makes the work difficult. But it is necessary to watch the place carefully for a long time after, on account of the smouldering embers in stumps and logs or in the leaf mold, which are liable to be fanned into flame again by the wind; and this may occur at any time within a week or more.

A top fire is one which sweeps through the tops of the trees, creating a mass of furious flames that consume foliage, branches and tree trunks as well as the inflammable material on the ground. This kind of a fire is very difficult to control. If a strong wind is blowing, as is apt to be the case, little can be done to check its progress when once fairly started. These sweeping top fires will often burn until extinguished by rain. In New York, a forest fire is almost invariably followed by rain within a few days. This phenomenon has been observed so often that many believe it to be the result of the fire. Its almost sure occurrence is a providential arrangement, even if it cannot be explained on meteorological principles. The fire fighters of the Adirondacks have a saying that rain is the best firewarden of all. It may be safely asserted that had it not been for this efficient and valuable agency, the forests of Northern New York would have been destroyed long ago.

The methods employed in fighting fire vary with the circumstances of the case. If it is a ground fire of small area, and no wind is blowing, one or two men can soon "whip it out" by using small bundles of brush or bunches of leafy twigs. If there is water handy, it is well, even then, to drench the ground thoroughly before leaving the place.

If the ground fire has spread over a large area, and is traveling fast, it then becomes necessary to rake or sweep up the dead leaves and litter until a wide strip of bare ground is thus made at some place towards which the flames are traveling, so that when the fire reaches this bare strip it will cease for lack of fuel. Where it is practical to do so, several furrows are plowed in making this safety strip or barrier; or, where there are enough men in the fire posse, the ground is dug up with shovels and the loose earth thrown in the direction of the fire. At the same time, other men follow in the rear of the fire and along its sides, whipping out or extinguishing the flames by whatever means they have at hand, so as to narrow in the

course of the fire and control it until the main force can head it off in front at the safety strip, or at some road or stream of water. The work is no easy task; for the men who are fighting the fire in front have, in addition to the heat, to contend with the masses of blinding, suffocating smoke that rolls along the ground in dense volumes, making the work exceedingly trying and exhaustive. Where there is water at hand, and the firewarden, when "warning out" his posse, ordered the men to bring pails or buckets, the smoke is less annoying; for the men along the rear and sides extinguish the smoking, half burned material by throwing on water, thereby rendering it easier for the men who are at work in front. The men, when ordered out to fight a fire, generally bring with them the necessary implements, including shovels, which are used to throw fresh earth on the little creeping flames; and rakes or brush brooms, which are handy in sweeping up the dead leaves, and in making a barrier or safety strip.

A ground fire on the side of a hill is more difficult to manage. It requires prompt action and energetic work, for it will run up the slope rapidly if unchecked. A mountain fire seldom runs down hill. If it does, its progress is very slow and easily stopped. But the flames will sweep up a hillside rapidly, even on a still day, the inclination of the land creating a partial draught, while the position of the timber facilitates the action of the flames just as a lighted stick will burn better when inverted.

A top fire, fairly started on its way, cannot be extinguished; nor can it be controlled except under favorable circumstances. The smoke and intense heat prevent anyone from approaching closely. It is also dangerous to work in front of one, as a man is liable to become surrounded by the flames and his escape cut off. Many lives have been lost in this way.

The only remedy for a top fire is in back-firing. This is done by selecting a suitable place in advance of the fire at some road, stream, or clearing, and then kindling counter fires on the side of the opening next to the coming flames. Care and good judgment must be exercised in starting back fires, in order that they may burn towards the advancing fire, and not escape in the wrong direction. After starting them the work is generally facilitated by the favorable breeze caused by the currents of air which naturally rush in from the outside towards the main fire. Back fires thus clear a space of material, so that when the main fire reaches the place it loses its force through lack of fuel; a good opportunity is then afforded for the men to fight it, and to prevent any further spreading. But too often it happens, when the men have succeeded in corralling the flames, that a gust of wind will carry burning brands, or pieces of blazing bark from some dry stubs or charred trees, carrying them high in air across the line of defense into the adjoining forest, and another fire is under full headway before the men can get there in sufficient numbers to put it out; or, the men

tired and worn out with their previous labors become discouraged by the fresh mishap and abandon the fight. The fire then burns until extinguished by rain.

In order that there may be proper protection and facilities for work there should be wide lanes cut and cleared at regular intervals, or at such places as the topographical features would render most efficacious. These lanes would furnish frequent and advantageous lines of defense, and would be especially adapted to the work of back-firing. At present, the roads and streams in our Adirondack forests are too few and far between to furnish always the necessary lines on which to contest the progress of a fire; and, owing to the forestry clause in our State Constitution, we are forbidden to cut any timber for fire lanes or any other purpose. The immunity from fire which is such a noticeable feature in the management of European forests is due largely to the construction of fire lanes. Whenever we are allowed to make such openings in our State forests, and they are properly cared for by keeping the ground perfectly clear of all vegetation, we shall have very few fires to record in our annual reports.

Experience has shown that when a fire attains full headway, and is running in the tree tops as well as on the ground, the best time to fight it is at night, after sunset or before sunrise. During these hours there is apt to be little or no wind; and under the repressing action of the damp night air the flames, which raged so fiercely at noon, die down and can be controlled or extinguished. One man after sunset is worth ten men at noon. Experienced fire fighters understand this, and so do most of their work in the evening and early morning hours. During the day they rest or sleep, while a few of their number busy themselves with preventing, so far as possible, the fire from spreading.

The systematic effort made in New York to prevent loss from this source shows that forest fires can be materially reduced in frequency and extent. Though they still occur here, they are a small matter as compared with those of former years. Prior to 1885 it was a common event, an almost annual occurrence throughout the State, to have the atmosphere obscured by the smoke from burning woods—a thick, blue haze through which the sun at noonday appeared like a dull, red disc. This phenomenon is no longer seen in our State except as a local condition.

While the system of having a firewarden in each town has proved effective in extinguishing many fires promptly, the greatest good has resulted from the education of the people, by posting annually thousands of printed notices throughout the woods and adjoining districts, on which are plainly printed the rules and regulations of the Forestry Department relating to these matters, and urging that the utmost care be taken in the use of fire. The best way to fight fires is to have no fires; and if everyone were as cautious and thoughtful as they should be in this respect, there would be none to fight, and no loss from this source.

The people living in or near the forests, and those who are there temporarily, should be thoroughly educated as to the proper use of fire, and the evils resulting from carelessness. More good can be accomplished along this line than by police regulations and penalties, although the latter are absolutely necessary, also. If, in addition to knowledge and thoughtfulness in these matters, everyone would act honestly and conscientiously, would refrain from carelessness as they would from crime, there would be no more forest fires.

Through the efforts of the Forestry Department and co-operation of the people the large and destructive fires have ceased to occur. Whatever regret there may be at not achieving complete success is largely tempered with satisfaction over what has already been accomplished.

VENISON FOR THE CAMP.

No. V.

Tree Planting.

TREE planting is one of the best expressions of altruism; for the man who plants trees is thinking of others rather than himself. If by his act he encourages other people to do the same, he develops "the highest altruism."* He assists people to gratify their love of the beautiful, to enjoy better health, to become more prosperous, and so makes the world better and happier for his having lived in it.

Trees should be planted because they purify and cool the air, increase the value of surrounding property, and gratify our love of the beautiful. They should be planted along the highways, on our village and city streets, on lawns and in parks, on schoolhouse grounds, on the farm, in the dooryard, and wherever shade or shelter may be needed.

Highway planting. Trees should be set out along every road for shade. In addition, the farm lanes can be profitably lined with fruit or nut-bearing trees that will bring money to their owner and add to the attractive appearance of his surroundings.

Objections may be made in some localities against placing trees along a public road because their shade would tend to make it wet and muddy. If such conditions exist the fault is in the road, and not in the trees. When a roadbed is properly constructed, drained, and ditched, the trees will do no harm. On the contrary, they will furnish a grateful shade to the traveler, preventing dust without creating mud.

One of the finest, smoothest roads in the State may be found in the Adirondack Forest—from St. Hubert's Inn to the Ausable Lakes—, and yet it is completely shaded by trees that meet overhead, shutting out the sun except where the road is flecked with light that streams through the interstices of the leafy cover. But this road was constructed in proper shape and of suitable material.

There are roads along which no trees are allowed because the sun is needed to dry up the mud and sloughs which in spring make travelling slow and difficult. But in summer the sun baked mud is pulverized under the wagon wheels, creating clouds of dust that are worse than the mud. With a well built road, shaded by trees, both of these nuisances would be avoided.

Even a poor road will permit of one row of trees, which should be placed on the south or west side as its direction may require.

The law of 1869, which is still in force, provides that any inhabitant liable to highway tax who shall plant by the side of a public road "any forest shade trees or fruit trees" shall be allowed in abatement of his highway tax one dollar for every four

* Herbert Spencer.

trees set out. This law specifies that elms must be planted at least seventy feet apart; that maples "or other forest trees" shall not be set nearer than fifty feet, except locusts, which may be set at intervals of thirty feet. Fruit trees must be planted at least fifty feet apart. Proper penalties are prescribed for anyone who shall injure a tree; or who shall hitch a horse or any animal to, or leave the same standing near enough to injure, a tree used for shade or ornament at "any school house, church, or public building, or along any public highway."

The kinds of trees mentioned in the law are well adapted to highway planting; and the distances apart at which they must be set are based on the space which each species is known to occupy. Nothing has been found that will equal our American elm and hard maple for wide roads and double rows. As our elms often attain a spread of one hundred feet it is evident that the seventy feet demanded in the law is none too wide a space. The trees should be allowed to assume their full size and natural shape without crowding or interference from each other. Transplanted, or "second growth," hard maples along a country road attain a large size and beautiful appearance which requires all of a fifty foot space. Other species—oaks, basswood (or linden), white ash, locust, willow, horse chestnut, black cherry, buttonball (or sycamore), beech, and the two soft maples—can be used with good results in order to obtain variety. By planting the scarlet oak, red maple, and pepperidge (or sour gum), the brilliancy of the autumn coloring can be enhanced by the bright reds which the leaves of these species afford.

In some localities the elms have suffered so from insects that it may be necessary to discontinue planting them unless some simple, inexpensive remedy can be found which will be available for highway trees in the open country. The spraying engines that have proved successful in the cities would be too expensive to operate on country roads. The white or silver maples have been attacked by insects lately, both in the Adirondack forests and in the village streets. The horse chestnuts have been defoliated, also; and it may be that other species of trees will be attacked in time.

There are some forest trees which are not adapted to roadside planting, because they assume a different form when grown in the open, the branches growing lower down, and the trunk failing to reach its usual height, although it may attain a large diameter. For this reason, the birches, especially the yellow birch, are not desirable for shade trees or roadside use.

Nut-bearing trees, the chestnut, butternut, and the hickories, are available for highway planting They are handsome, large trees, each species having peculiarities of habit that makes it worth the notice of an observant traveler. Their branches may suffer from boys in quest of nuts; but that is very liable to happen wherever these trees may stand.

MEAL TIME IN A LUMBER CAMP.

In some European countries the roads are lined with fruit trees. But there it is well understood that the fruit, though it overhangs the highway, belongs to the farmer, whose property is respected accordingly.

In this country, where such widely different. ideas prevail, it would be necessary to concede the traveler's right in case fruit trees were planted along or within the "right of way."

Street planting. There are many good reasons why trees should be planted in cities and villages. During the hot days of summer the streets which are shaded by trees are preferred to those which are not. The temperature is much lower. As the pavements are not exposed to the glare of the sun, there is less of reflected heat. The streets that are lined with shade trees are more attractive to the eye; their superiority is readily apparent when compared with streets on which there are no trees. Shaded streets are cooler and more desirable for residences; and, other things being equal, property on these streets is more valuable and commands higher rents. The air is purer by reason of the foliage, which inhales carbonic acid and exhales oxygen. During hot, summer days, the diseases incidental to that season are not so prevalent in streets and localities which are protected from the heat of the sun by large, overhanging trees.* The leaves absorb the poisonous gases generated in hot weather by the decomposition of animal and vegetable matter, and thus another factor of disease is eliminated. At a recent meeting of the New York County Medical Society a resolution was passed in which the opinion was expressed that "one of the most effective means for mitigating the intense heat of the summer months, and diminishing the death rate among children is the cultivation of an adequate number of trees in the streets."

The city of Washington is justly known as one of the most beautiful cities in America on account of the seventy thousand trees planted along its streets; and there are many New England towns famed for their attractive appearance which is due to the beautiful trees planted by village improvement societies.

In street planting care should be exercised to select trees which, when fully grown, will be of a size suitable to the width of the street; and in the choice of species only such should be selected as are best adapted to the peculiar conditions which influence their growth in cities. Some trees which can be safely used for road planting in the country are too susceptible to the deleterious influences of the smoke, dust, gas, and pavement of our cities.

Along country roads or village streets, trees transplanted from some neighboring grove or forest may be set out; but for city streets nursery stock alone should be used.

* See "Vegetation, a Remedy for the Summer Heat of Cities." By Stephen Smith, M.D., LL.D. Appleton's Popular Science Monthly, February, 1899.

In fact, it would be better to buy nursery trees for village planting, also, unless compelled to use the other for economical reasons. If one must go to the forest for young trees, pains should be taken to obtain as straight, thrifty, and perfect specimens as possible.

Selection of trees.—In making a choice the first thing to be considered is the width of the street; also, the width of the sidewalk or nearness of the houses. Some trees, the elm for instance, will injure the foundation walls of a house by the pressure from their far spreading roots. Where the house line is near the curb, trees with a tap root are preferable.

The following list includes all, or nearly all, the species which are desirable for street planting. They are named in the order of their desirability, although in some instances their preferment is somewhat a matter of taste concerning which any discussion would be a waste of time.

WIDE STREETS.	MEDIUM WIDTH AND NARROW STREETS.
American or White Elm,	Norway Maple,
Sugar Maple,	Silver Maple,
Tulip Tree,	Red Maple,
Basswood (Linden),	Ailanthus,
Horse Chestnut,	Cucumber Tree,
Sweet Gum,	Ginkgo,
Sycamore (Buttonball),	Bay Willow,
Oriental Sycamore,	Pin Oak,
White Ash,	Red Flowering Horse Chestnut,
Scarlet Oak,	Yellow Locust,
Red Oak,	Hackberry,
White Oak,	Catalpa (*speciosa*),
Honey Locust,	Lombardy Poplar,
American Chestnut.	

The Elm (*Ulmus Americana*) stands first on the list by right of its superior size, beauty, and adaptability to street planting. It is rapid in growth, withstands transplanting and pruning better than most other trees, and will grow on almost any soil. Its habit is such that any pruning of the lower limbs is seldom necessary, a valuable feature in a street tree. It thrives not only on country roads and village streets, but also in our larger towns. New Haven has attained national fame as the "Elm City," on account of the many and beautiful trees of this kind which line its streets. There are various forms of the American elm. Emerson, in his "Trees of Massachusetts." describes three distinct shapes. The most desirable form for a shade tree is that of the umbrella shaped top with slender, pendant branches on its outer edge. In transplanting, or in giving orders to a nursery, care should be taken to secure this particular form of tree. The English and Scotch elms have been planted extensively in some places; but as these species are inferior in appearance and other respects their use

should be discouraged. The English elm retains its foliage longer each fall, but that is all that can be said in its favor. On the other hand, it is much more liable to attack from insects.

The Hard Maple, or Sugar Maple, is so well and favorably known as a shade tree that it is unnecessary to dwell here upon its beauty and symmetrical proportions. It is seen at its best in village streets and along country roads, where the conditions are better suited to its fullest development than in the cities. In the crowded streets of large towns this tree, in some places, has been unable to withstand the effects of smoke, dust and other deleterious influences. But it can be planted with good results on streets where the houses stand on large lots, with plenty of ground or wide lawns around them. On city blocks where the houses are in solid rows it may be better, in some cases, to use the Norway maple, a nursery tree which remembles the native hard maple closely, although not so large. The Norway puts out its leaves earlier in the spring, and retains its verdure later in the fall. The varied and brilliant autumnal colors displayed by the leaves of our native hard maple make this species desirable for ornament as well as shade. No other tree combines so many shades of color in the fall—scarlet, orange, yellow and green. These different hues may be seen on one tree, often on one branch, and sometimes on one leaf.

The Tulip Tree will compare favorably with the hard maple in height and beauty. In favored situations it attains a height of 125 feet or more, with a diameter of six to eight feet. It bears transplanting well, grows rapidly, is very hardy, and is free from destructive insects. The constant, tremulous motion of its broad leaves gives this tree a lively, attractive appearance. In the latter part of May it decks itself with terminal flowers of a dark, rich yellow, streaked with green and orange.

The Basswood, or American Linden, commends itself to the lover of trees by its ample shade, fragrant flowers, and bright green foliage which, in spring, contrasts well with its dark-colored branches. In the fall its leaves assume a rusty hue that detracts somewhat from its appearance then, especially, as most of the other trees are displaying their autumnal coloring at that time. In the arrangement of its limbs and branches the linden displays a graceful habit after the leaves have fallen, making it an attractive and desirable tree in winter. The curious, ribbon-like bract to which the pea-shaped seeds are attached makes this tree in early summer an interesting study to the passer-by. The linden is extensively planted as a shade tree in Holland and some other European countries. In Berlin one of the principal avenues, Unter den Linden, takes its name from the beautiful trees that shade its walks and drives.

The Horse Chestnut is the earliest of our trees. Before the buds have opened on many of the others, and while the willows are showing only a "green mist," the horse chestnut unfolds its cunningly packed leaflets to the sun. It is a welcome sight to

those who are waiting and watching for spring. Its large compound leaves (the *Æsculus hippocastanum*) afford a shade more dense than that of any other tree. In parks and on lawns, where its growth is not restricted, this tree assumes a grand, massive appearance that always arrests the eye. In early spring it is gay with large white and pink flowers whose erect panicles standing on the upturned tips of the branches are suggestive of a leafy candelabra, an effect that is heightened when one remembers the peculiar appearance in this respect of the tree in winter. Objection has been made to the horse chestnuts because at times there is too much litter on the sidewalks under them. But, if people sweep their sidewalks daily there need be no trouble from this source; and if they do not keep their walks clean they will neglect their trees, also, in which case it is immaterial what species is planted. The question of insects is discussed later on.

The Sweet Gum, or Liquidambar, so named from the fragrant balsam which exudes when the trunk is wounded, is an ornamental tree of about eighty feet in height and two feet in diameter. In some localities it attains a much greater size. It is a rapid grower and thrives on almost any soil. Its glossy, star-shaped leaf makes it a favorite with all students of phyllotaxy. In autumn its foliage changes to a deep crimson interspersed with yellow. Where a variety of species may be deemed desirable this tree should not be omitted. In street planting it could be used for several blocks with good effect.

Of the various species of Ash, the White Ash is the one best adapted for ornament and shade. It may be classed fairly among the large trees, the trunk attaining considerable height before it subdivides, which, like the elm, makes it desirable for street purposes. Its foliage is pleasing in appearance, growing in irregular, waving masses, but without any abrupt or broken outlines. The ash is among the last to put out its leaves in spring and among the first to lose them in the fall. In the latter season its foliage assumes a variety of colors, violet, brown, and dark chocolate. Wilson Flagg notes that the ash is the only tree that shows a clear brown as one of its regular series of tints in the living leaf. Like most trees with compound leaves it sheds its spray with the leaves in fall, leaving naked, angular branches that detract from the beauty of its habit* in winter. Its freedom from disease and insects commends it to all tree planters.

In street planting, the oaks have hitherto been used but sparingly. The few that appear here and there along country roads seem to owe their existence to accident rather than design. This is probably due to their slower growth, a disadvantage which is fully offset by their hardiness and longer life. The oak is a noble tree, its size and sturdy character entitling it to a prominent place in our streets and parks. In

* Botanical term relating to the general aspect of a tree, arrangement of limbs, or mode of growth.

CROSS-CUTTING THE TREE INTO LOGS.

growth it is no slower than some other species which have been freely planted. The village of Flushing, L. I., is noted for the beautiful oaks that shade some of its streets.

The Scarlet Oak is a desirable tree for many reasons, one of them being the crimson leaves which charm the eye long after the other trees are bare. Its foliage is unusually persistent, and in some seasons the ruddy glow of its leaves may be seen in brilliant contrast with the first snow.

The Red Oak has the most rapid growth, attains the greatest size, and exhibits the best proportions of any of the acorn-bearing species. It has less of the gnarled and contorted habit so characteristic of the oaks in general.

The White Oak is superior in vigor and longevity. It does not grow as tall as the red oak, but attains a greater spread. Its russet-colored leaves are very persistent, often clinging to the tree during the entire winter, a feature regarded by many with unfailing interest. It is to be hoped that, with the revival of tree planting in our towns and villages, the oaks will receive the consideration which their many good qualities deserve.

The Honey Locust is the latest of our trees to put forth its foliage. This is the only thing that can be said against it; and that is not always a disadvantage. When its pinnate leaves do appear, their waving, feathery spray fully excuses its tardiness by its beauty. It is a tall, graceful tree, free from insects thus far, and is well entitled to a place along our streets and in our parks. Where a dense, cool shade is wanted, the honey locust would not answer the purpose, owing to its open foliage through which the sunlight streams freely.

Where rapid growth and great size is desired, the Sycamore, or Buttonball, may claim a place. Its lower branches are high above the ground, affording an open space beneath the tree—which is often desirable when planted near a house—and furnishing ample shade without obstructing the view of the street or road. The sycamore is always noticeable on account of its peculiar bark and the globular appendages or "buttonballs"; but, owing to its irregular, inferior habit and liability to fungal diseases it should be used sparingly in the streets or parks, and only where variety is desired. The European sycamore (*Platanus orientalis*) or Oriental Plane, which resembles the American species closely, is preferable in every respect, and can be obtained from any nursery.

Hitherto the American Chestnut has not been planted on our streets or roads; but there is no good reason why it should not be given a place occasionally. It grows very fast, attains a large size, is handsome in form and proportions, and fulfills all the requirements of a first-class shade tree. The boys might prove troublesome when the fruit is ripening; but that is all that can be said in objection, a difficulty easily obviated by a little care during the short time in which the burs were opening.

The White or Silver Maple is a favorite shade tree in both town and country. It bears transplanting as well as any other, grows rapidly, withstands pruning, and is exceedingly graceful. Its slender, pendant branches are easily swayed by the breeze, giving it a waving, flowing appearance, which is made still more attractive by its silvery hue when agitated by the wind, the under side of the leaves having a whitish color which is then exposed to view.' The deeply cleft shape of the leaves adds also to its beauty.

The Red Maple is a rapid-growing tree. In addition to many of the good qualities belonging to the maples, it displays a scarlet leaf in early autumn, which changes later to a dark crimson. Its foliage is the first to change color, some trees showing their red leaves early in August. Its conspicuous red flowers make it noticeable, also, in early spring. As it seldom attains full size when planted in cities it is well adapted to narrow streets.

There seems to be a general prejudice against the Ailanthus; and yet it withstands the injurious effects of city life better than any other species. It has a peculiar beauty, also, in the graceful sweep of its large, pinnate leaves which are suggestive of the staghorn sumach, and which remain green until they fall. Objection has been made to the disagreeable odor of its flowers. But this lasts for only a few days, and can be entirely obviated by planting pistillate trees. The peculiar bark, in which there is traced an arabesque-like pattern, makes the Ailanthus an interesting study to all lovers of trees.

The Cucumber Tree is a magnolia of stately growth, with a trunk from sixty to eighty feet in height. It grows rapidly, develops a pyramidal form, and fulfills all the requirements of a desirable shade tree. It is advisable to use a small tree in transplanting.

For narrow streets, or where there is little space between the house line and the curbstone, the Ginkgo is well adapted, as it does not attain a wide spread. When fully grown it is over sixty feet high; but in New York, with its cold winters, this species does not grow to its full size, although hardy and thrifty in other respects. This tree is not slow in growth, but still it furnishes little shade until it approaches maturity, when it assumes a tapering form with ample foliage. Thus far the ginkgo has been free from destructive insects. Its peculiar, fan-shaped leaves, in form like those of the maidenhair fern, retain their olive green color until early autumn, when they change to a rich yellow. Though not an evergreen it is a conifer, of the Yew family, a distinction seldom noticed by many who are familiar with the appearance of the tree.

The Willows furnish some species that are available for shade and ornament. The one best adapted for street planting is the Bay or Laurel-leaved Willow (*Salix pen-*

tandra). As it is not a large tree it should be reserved for narrow streets. Its slender, tapering leaves, which are bright, glossy, and of a deep green on both sides, form a conspicuous feature of this species.

The Pin Oak may be described as a middle-sized tree, available for streets and roads of medium width. In leaf form and general massing of its foliage it will compare favorably with any of the oaks. Its smooth, deeply pinnatifid leaves, bright green on both sides, add to its beauty. The pin oak thrives best in moist ground.

The Red Flowering Horse Chestnut is smaller than the common horse chestnut, and, hence, is better adapted to narrow streets, provided a tree of this kind is deemed desirable. During the flowering season the rose-colored petals on the upright panicles make this a beautiful and attractive tree.

The Common or Yellow Locust is one of our most beautiful trees on account of its profusion of pinnate leaves and the pendant racemes of white flowers which in June fill the air with an agreeable perfume. The locust is reputed to be a favorite nesting place for birds, the thorns furnishing protection from many of their enemies. This tree grows rapidly, and its size makes it desirable for streets of medium rather than narrow width; but, owing to the brittle character of its branches it should not be placed where it will be exposed to strong winds.

The Hackberry or Nettle Tree is a medium-sized tree which, in its general appearance, strongly resembles the elm. Its straight trunk does not divide until it has attained considerable height, a peculiarity which is an advantage in a street tree; but, as its roots generally rise above the ground for some distance from the trunk it is better adapted to village streets or wide avenues where the flagstones of the sidewalk do not extend to the curb. While it is not a tree of the first magnitude it is generally too large for narrow streets. The hackberry is easily transplanted, grows fast, and is free from insects. Though a native it is rarely found in our woods; if necessary, young trees can be obtained from the nurseries.

The Hardy Catalpa is a small tree of erect habit, broad leaves and ornamental character—a desirable shade tree in certain situations. In July it is resplendent with white, or violet-tinged flowers which grow in large, upright, pyramid-shaped clusters. Objection has been made to the catalpa as a street tree, because it is liable to injury from people who persist in breaking off the flowering branches. For this reason the lower branches should be trimmed sufficiently to prevent any injury from this source.

The spire-shaped, erect form of the Lombardy Poplar makes it available for narrow streets and sidewalks. A single tree of this species, properly placed in a park or lawn, often makes an effective addition to the beauty of the landscape. It has the advantage of rapidity in growth which, in turn, is offset by its short life. It casts but little shade, and so its use on country roads should be discontinued. It is a great

favorite as a road tree in some parts of Europe, especially in France, where it may be seen in unbroken rows stretching away for many miles.

The reason for including certain trees in the foregoing list, and also the omission of others, may be questioned by some whose experience in arboriculture makes them competent authorities in everything relating to tree planting; but the list is not offered as furnishing anything like a definite, absolute rule. As already stated, the proper selection of trees for streets and roads is largely a matter of opinion and taste, replete with pros and cons. It would be presumption for anyone to attempt to offer a list that would meet all requirements with absolute certainty. The names submitted here are offered in the way of suggestion rather than authoritative information, and are intended for the benefit of those who may not have the opportunity or inclination to study the question exhaustively.

Destructive insects.—Objection will probably be made to some of the species named because of their liability to injury from destructive insects. But if all such trees are to be thrown out, the choice will be narrowed down to a very few kinds, the excluded ones embracing many of our finest and most popular shade trees. Even then, there is no assurance that the remaining species, although free from insects hitherto, will continue in their immunity. The freedom of certain trees from insect blight is due largely to the fact that few have been planted, and that the pests find plenty of food in the other species. While it may not be possible to exterminate these borers and insects, or prevent entirely the injuries from this source, the evil can be so controlled that their destructive work can be greatly minimized; and, as regards some species and insects, entirely obviated. It would seem that the better plan is to continue planting whatever species may be desirable, and, then, through intelligent methods and faithful work control the evil so far as possible. The potato bug was a formidable enemy at one time; but the farmers kept on planting and fighting until they succeeded in overcoming the trouble. It has been demonstrated that by spraying trees, by using suitable emulsions and insecticides, and by gathering the cocoons, the destructive work of insects can, for the most part, be prevented or, at least, controlled. But the work must be done in time each season, and prosecuted vigorously. The State Entomologist is ready at all times to furnish information and advice to all who need his assistance. With proper care and attention the trees can be protected; but, if this care and attention will not be given, the selection of the tree is of little importance.

Undesirable species.—Some trees were omitted, not so much on account of doubtful qualities as because the list already offers ample opportunity for selection from the large number named. There are, doubtless, several other species, which might be planted with satisfactory results; but many of them have defects which should be considered carefully before making a selection.

AN ADIRONDACK LOGGING CREW.

The Ash-leaved Maple puts out its lower branches too near the ground to permit of its use on streets. The Canoe Birch does the same; and if the lower branches were cut off the pyramidal form of the tree would be destroyed and its beauty greatly impaired. The Kentucky Coffee Tree is so unsightly in winter, resembling then a dead tree, that it is better omitted in street planting, especially as it will thrive only in good, moist ground. The European Ash lasts but a few years in our climate, and is in no way superior to our American White Ash. The Sour Gum, or Pepperidge, is a beautiful tree in autumn, but it is too apt to fail in transplanting. The Mountain Ash and Flowering Dogwood are beautiful, but the bright red berries of the one and attractive flowers of the other invite injury; their proper place, if on a street or road, is inside the fence and in some door yard. The Sycamore Maple has a fine appearance and dense shade; but with so many other maples it is hardly needed. Its place is in the park or arboretum. The Yellow Wood is one of our neatest, prettiest trees, with cream-colored flowers that attract swarms of bees when in bloom; but it has low branches, and its wood is so brittle that the trunk is very apt to split downwards from where it first divides. The Carolina Poplar or Cottonwood (*Populus monilifcra*) is often recommended because of its very rapid growth; but this tree sheds a downy, cottony tuft which clings to whatever it falls on, causing so much annoyance that, in many towns, orders were issued for its removal. All of these trees are pleasing in appearance and each has some good qualities to commend its use; but they should be reserved for lawns, door yards, and parks, where they will appear to better advantage than along the curbstones.

None of the evergreens have a place on the list, for they are of little use as shade trees. Most of them are forest trees which, when growing in the open, assume a different habit, their lower limbs commencing at the ground. A row of White Pines, properly trimmed, might be used on a country road, and the Tamarack, or American Larch, looks well in the farmer's door yard; but all evergreens require skill and great care in transplanting, and seem out of place in city streets. Many of them, however, are highly ornamental, and very useful for park and lawn purposes.

Rapidity of growth.—Trees have been described here as of rapid growth and slow growth. These are largely relative terms which to some people may convey but little meaning. They will be better understood when the growth rate of some of our well known species is noted. Twenty years after planting, the following named trees will, under ordinarily favorable conditions, attain a diameter approximately as follows:

White or Silver Maple, ...	22 inches
American Elm, ...	19 "
Sycamore or Buttonball, ...	18 "
Tulip Tree, ...	18 "

Basswood,	17 inches
Catalpa (*speciosa*),	16 "
Red Maple,	16 "
Ailanthus,	16 "
Cucumber Tree,	15 "
Chestnut,	14 "
Yellow Locust,	14 "
Horse Chestnut *(hippocastanum)*,	13 "
Hard Maple,	13 "
Honey Locust,	13 "
Red Oak,	13 "
Scarlet Oak,	13 "
White Ash,	12 "
Pin Oak,	12 "
White Oak,	11 "
Hackberry,	10 "

Trees may be planted in the spring or fall, preferably in the spring before the buds open. If, through lack of information or experience, there should be a difficulty in determining what to plant, it would be well to note the kinds that thrive best in the vicinity, and choose accordingly. Having decided on the species, the tree or trees should be ordered from some nursery, because, as a general thing, better results will be obtained. Nursery stock bears transplanting better than that from the woods; for the roots are not spread out so widely as those of forest trees which, by reason of poorer soil, are obliged to reach out farther for nourishment, and, hence, sustain more injury when the tree is dug up. In size the plant should be about two inches in diameter near the ground, and from ten to twelve feet high. Nothing is gained by using larger ones, as the smaller trees soon overtake or pass them; and, the larger the tree the greater the risk in transplanting. Maples, elms, and lindens, however, may be used with larger diameters than other species. The oaks thrive best when the smaller sizes are planted.

Nursery trees cost from fifty cents to one dollar each, according to size or scarcity, to which must be added the expense of freight and cartage. When ordered in large quantities, a suitable deduction in price is made.

But for villages and roads it may be more convenient and economical in some localities to obtain the young trees from the neighboring woods. In that case pains must be taken to select straight, thrifty specimens, with clean, healthy bark, well-shaped top, and regular arrangement of branches.

Transplanting.—In digging up a young tree the roots should be preserved as far as practicable, the circular trench being at least six feet in diameter, or three feet from the stem in all directions. Any unnecessary breaking or wounding of the roots must

be avoided, and all the slender rootlets should be secured as far as possible. The more earth that can be taken up with the roots the better. A solid lump is not necessary; but whatever soil clings to the roots should be retained and not allowed to fall off through jolting or careless handling.

The stem of the tree should be cut back from the top; but the frequent method of pruning a forest sapling down to a bare pole is not advisable. It is better to allow three or four of the lower limbs to remain, selecting those which will give the best arrangement; and then, in cutting them back, leave one bud on each. This will make a better shaped tree in time.

The severe pruning of the transplanted tree is necessary on account of the loss in its roots. The more roots are cut off, the greater the amount of pruning needed.

There must be a new growth of root fibres before the young tree can support its foliage safely. The leaves of a healthy tree are nourished by the sap which is drawn from the roots as fast as needed; but if this tree is transplanted the supply is partially cut off until new roots and fibres are formed to replace those lost in transplanting. If, during this period, the leaves and branches are allowed to keep on draining the sap they will exhaust the supply in the tree before the new roots are grown, and the tree will soon wither or die.

Having dug up the tree examine the roots carefully; cut off cleanly and smoothly, with a sharp knife, all the bruised or broken ones, cutting them back to the sound wood. Then these roots will not decay, and the new fibres or rootlets will grow quickly. If there is a long tap root it should be shortened to conform to the depth of the hole in which the tree is to stand. Do not allow the roots to be exposed to the sun or wind; cover them up immediately with damp straw or bags. If the fibrous roots become dry through lack of this precaution the work will probably prove a failure.

The holes in which the planting is to be done should be dug before the trees arrive; and the earth for filling should also be in readiness. The holes must be large enough so that the roots can be spread out in their natural position without cramping them in the least. It is well to dig the holes so that there will be a foot or more of additional space on all sides, and of ample depth This is especially necessary in poor soil. In digging, throw the top soil to one side, and cart away the poorer earth which came from the lower part of the hole. In place of the latter use a rich soil, one-fourth manure, thoroughly mixed, worked until it is fine, and free from lumps, sods, or stones. Use no manure unless it is thoroughly mixed with earth; if it touches the roots it will burn or rot them.

In setting the tree two men are necessary. One is needed to hold the tree upright; the other will be fully occupied in shoveling in the earth and then working

it with his hands under and closely around the roots and fibrous branches. The earth must be thrown in slowly and in small quantities at a time; as fast as thrown in it should be rammed or trodden down until there can be no air spaces, and until every rootlet is brought in close contact with the soil. No water should be used; it is not necessary. If dashed into the hole, as sometimes done, it is apt to wash the earth away from the roots in places, leaving air holes. If water is used it is better to sprinkle the sides and bottom of the hole before planting; also, the surface of the ground after the work is done. Frequent and thorough ramming is necessary. Young trees that have wilted and seemed to be dying, have been restored quickly to life and vigor by using heavy rammers that brought the loose earth in contact with the roots again.

In addition to a rich soil it is highly essential that there should be good drainage. Moisture is beneficial; but if water collects around the roots the tree will die. Clay is impervious to water, and if a stratum of this soil is found near the bottom of the hole, drainage must be provided, either by digging a passage through it, building a stone drain, or sinking a very deep hole which can be filled to a proper height with broken rock, gravel or ashes.

A tree should be set at the same depth that it formerly occupied; but when the hole has been filled the surface may be rounded up sufficiently to allow for the settling of the earth. If exposed to strong winds the young tree should be "staked," and fastened to the stake by strips of cloth or any appliance that will not injure the bark. In setting out a forest tree it may be well to place it in the same position as to points of compass which it originally occupied. A cloudy day is better for planting than when the sun shines clear and hot.

After the tree is planted the ground should be covered with a mulch, three or four inches deep, of straw, hay or manure. The latter will serve, also, as a fertilizer. If nothing else is done, the loose stones that came out of the hole can be thrown back on the ground to keep it moist. For a few years the surface of the ground around the tree should be loosened each season to prevent it from becoming dry and hard. Grass and weeds should be kept out, as they weaken the growth of a young tree.

Although spring is the better time for transplanting, it may be desirable under some circumstances where nursery trees are used, to order them in the fall, and then heel them in until spring. "Heeling in" is temporary planting in a trench, or merely placing them in the ground and covering the roots with a thick layer of closely packed soil to exclude the air. They can be placed closely together, and should be set in a slanting position with the tops inclined away from the prevailing winds. Heeling in is also resorted to when nursery stock arrives before preparations have been made for planting.

This method is favored by some because, when trees are taken up in the spring the "callus" which forms on the mutilated roots will not put out its white, hairy-like fibres in time to furnish sap for the early buds that are dependent on them; but when taken up in the fall and heeled in, the callus forms during the winter, and is ready with its new fibrous growth to furnish nourishment as soon as transplanted.

Pruning—As trees grow larger and older they require pruning occasionally to improve their shape, to remove dead limbs, and, in the case of very old trees, to restore them to vigor. This work should not be entrusted to ignorant, inexperienced men, as is too often the case. Men of this class frequent our cities and solicit employment as tree pruners. With glib tongues they describe the defects, real or otherwise, in street or lawn trees, and obtain permission to do some work. As a result beautiful specimens have been disfigured or irremediably injured in many of our cities. Whenever any extensive pruning becomes necessary proper means should be taken to secure the services of skilful, experienced men, with testimonials or recommendations signed by some competent authority in such matters.

Some of our best shade trees can be improved in appearance occasionally by trimming or cutting back in order to correct irregularities or attain some form better adapted to the situation. Such work can be done without injury to the trees; but it can be done safely only by a skilful, professional tree pruner.

When a tree becomes "stag headed" by dying at the top, the dead limbs thus exposed should be cut off, and the rest of the tree may be trimmed somewhat to correct the irregularity in its general outline. Old trees that have become bare and unsightly may often be restored to temporary vigor and clothed with foliage by severe pruning. But, with the latter exception, all pruning is better done sparingly. Some species, hard maples for instance, along a walk or driveway can be made more serviceable under certain conditions by increasing their height, which is accomplished by cutting off a few of the lower limbs. But this operation requires careful, intelligent work, and should not be resorted to unless there are special reasons for it. Pruning is necessary, at times, the same as surgery, and is successful only when skilfully done.

Whenever a branch is removed, whether a dead or a live one, it must be cut off close to and even with the trunk, no matter how large the wound. The new wood and bark will then, in time, cover the denuded space. The process by which this recovery is accomplished is well explained in Des Cars treatise on tree pruning,* a copy of which should be in the possession of every one who owns or has charge of trees. If a branch is not cut off close to the trunk, the projecting stub soon decays, its bark falls

* A Treatise on Pruning Forest and Ornamental Trees. By A. Des Cars. Translated from the French, with an introduction, by Charles S. Sargent, Professor of Arboriculture in Harvard College. Published by the Massachusetts Society for the Promotion of Agriculture. Boston, 1894.

off, and the stump remains "like a plug of decaying wood driven into the trunk," from which the rotten mass extends rapidly to the heart of the tree.

In removing a large branch, enough of the outer portion should be first sawed off to prevent its weight from splitting the wood downward beyond the point where the final cut is to be made. All wounds made in pruning should be covered with coal tar or some other preparation to exclude the air from the raw surface.

In street planting the trees should be placed with reference to the room they will need when fully grown, rather than with reference to the lot boundary. Otherwise, there will be irregularity, overcrowding, and unoccupied spaces. If a block is fully planted, the trees on one side of the street should stand opposite the spaces on the other side. An avenue should be planted throughout its entire length with the same species, or, at least, for several blocks. By using one species on a street, a stately, architectural effect is obtained that will always be pleasing and impressive. While variety may be desirable for its educational tendency, it should not be permitted because of the irregular, unsightly appearance caused by trees of different sizes and shapes. The advantages of a variety are better secured by planting different species on different streets. A change of trees may be allowed on rural driveways where the irregularity of the scenery will better permit such an arrangement; but, even then, it is better to avoid abrupt, repeated changes, by planting the same species for a considerable distance.

Protection of trees.—In towns and cities every tree, whether young or old, newly planted or of full growth, should be enclosed to a proper height in wire netting of a small mesh. Unless this is done, or some similar precaution taken, it is not worth while to plant. The necessity for some such protection is readily apparent on examining trees from the curbstone side, and observing the large number on which the bark has been gnawed by horses. There is a feeling akin to pity when one notes the patient, repeated efforts of the tree to repair the injury, and how it tries each year to cover the wound with new wood and bark, only to have it torn and widened by some fresh attack. It is wasted time to discuss punitive measures as a remedy for this evil. The horse is not to blame, and any law for the prosecution of the drivers would be practically inoperative. A more sensible way would be to protect the tree by some of the simple, inexpensive devices which are available. But this in turn will never be done until the care of the trees devolves upon the city authorities. The man in a rented house will not invest a cent to protect the one in front of his residence; and the landlord cares nothing about it so long as he gets his rent.

Municipal control.—The planting of street trees and their subsequent care should devolve on the city government, preferably on the park commissioners, as the officials in that department would be better qualified for the work, farther removed from

MEASURING AND MARKING LOGS.

political influences, and would be more apt to have the long tenure of office necessary to the proper management of the work. The planting and care of street trees belongs to the city government as much as street paving. Under the stimulus of local improvement societies enthusiastic individuals plant trees; but when they sell their property or move away, the trees are apt to be neglected. Moreover, it is impossible without municipal control to secure the concerted action necessary for planting a street its entire length with uniform and properly selected species.

Then again, under the management of a special city department, properly supplied with funds, the spraying of trees and suppression of insect pests can be successfully accomplished; but it is doubtful if our trees can be preserved from this evil through the partial and disconnected efforts of individuals.

As in Washington and Paris, every city should establish nurseries supported by municipal appropriations, in which the various species best adapted to street planting can be propagated and grown with special reference to such use.

People who question the advisability of planting shade trees in cities, rehearse the old story about the injurious effects of smoke, dust and pavements, and then point to the sickly, deformed specimens in proof of their argument. But these unfortunate trees are the result of poor selection, bad planting, and neglect; and the blame should not be laid elsewhere. Asphalt pavement, though impervious to rain, will not prevent trees from obtaining moisture. On the other hand it prevents evaporation; the earth beneath it is always damp, for there is still a supply of water from adjoining areas and small underground courses. For years the street trees of Washington and Paris have grown and flourished on the asphalt pavement of those cities.

Let every citizen who finds enjoyment in well shaded streets make an effort to procure the passage of a city ordinance placing the entire control of the trees of his town in the hands of the park department or some special commission, and use his influence, also, to see that ample funds are annually appropriated to carry on the good work.

"Wide let its hollow bed be made!
There gently lay the roots, and there
Sift the dark mould with kindly care,
　　And press it o'er them tenderly.
As, round the sleeping infant's feet,
We softly fold the cradle-sheet,
　　So plant each shrub and tree."

Natural and Artificial Forest Reservoirs of the State of New York.*

By GEO. W. RAFTER, Consulting Engineer.

THE development of water-power in recent years has made everything relating to stream flow, water storage, and forestry not only of interest and importance, but even of great commercial value. Indeed, in order to insure a symmetrical development of all the resources of the State, it has become necessary that we understand the laws governing stream flow—or, more broadly, that division of the science of hydrology relating to stream flow. Moreover, the legislature has recently adopted the policy of purchasing large areas of land for the purpose of creating a State Park worthy of the great Commonwealth of New York, and for conserving stream flow.

The proposition to create the Adirondack Park is easily understood by everybody and has received universal approval throughout the State. The matter of conserving the flow of streams by preserving the forests on their head waters is, however, less well understood; and, indeed, one frequently finds popular statements to the effect that forest growths are without effect in this direction. Such views are usually founded on misinformation, and are held by many people who know nothing of the physical reasons why forests conserve stream flow.

It is proposed, therefore, to give in this paper, (1) a general veiw of the water resources of this State; (2) an account of the great Indian Lake reservoir built in the Adirondack region in 1898; and (3) some of the more useful physical data on which have been founded the view that, with other conditions remaining the same, a forested area will yield a larger run-off in the issuing streams than will a similar area from which the forest covering has been removed.

---

* The rapid development in our State of certain industries, together with the extension of electrical plants, has created a demand for storage reservoirs in our mountain forests, which will supply the necessary power to drive the machinery. The subject has been discussed so widely and is of such importance to our people that we have deemed it advisable to allow a portion of our Report to be used in a discussion of this subject. At the same time it should be understood that the views and opinions expressed in the following paper are those of the author, and that they do not necessarily represent the opinions or policy of this Commission.

sy
th
th
re
cr
cc

a
tl
w
t
f
p

It appears especially desirable to present these latter data in a single compilation, because they are widely scattered, never having been, so far as the English literature on the subject is concerned, with the exception of some of the annual reports of the Forestry Division of the United States Department of Agriculture and Bulletin No. 7 on Forest Influences by that department, even approximately brought together. Before proceeding to the main discussion we will briefly consider a few of the cognate heads.

WHAT THE ADIRONDACK REGION IS GOOD FOR.

The climate of the Adirondack region is mostly too severe for the ordinary agriculture of the low lands of the State of New York. During the last four years, in which the author has been more or less in the Northern forests, frosts have occurred there each season, at an elevation of about 1,800 feet, in both of the months of June and August, July being the one month of the year entirely free from frost. Under these circumstances it is impossible to raise corn, wheat or barley. Oats, potatoes and meadow grass are the ordinary agricultural crops raised, and even these only with difficulty because of the vast areas of boulders with which nearly the whole region is covered. As an economic proposition, therefore, the Adirondack region is good for but three purposes, namely: (1) For cultivating timber, which can be easily done under rational forestry administration without prejudice to the other interests; (2) for water storage, which, because of the numerous natural reservoir sites may be more cheaply carried out here than in any other locality in the eastern states; and (3) for a great State Park, which ultimately, by the construction of good wagon roads, may be made an easily accessible pleasure resort for the people of the State of New York.

OBJECTIONS TO FORESTRY AND WATER STORAGE.

Rather singularly the great mass of the people who go into the woods for pleasure regard forestry and water storage as inimical to their interests. They assume, indeed, that the Great Northern Forest should be preserved as a pleasure resort alone; and many with whom the author has conversed are apparently unable to see that the State owes any duty to its manufacturing interests. This position of the woods-going pleasure seekers, fishermen, hunters, etc., while extremely unsatisfactory, has still a certain rational basis underlying it all. It is due very largely to the indifference of the lumbermen in former years, when many acts of vandalism were laid at their door though to some extent unjustly.

THE SANITARY BEARING OF RESERVOIRS.

People owning cottages on the margins of natural lakes likely to be made into reservoirs, object very strongly on the ground that the raising of the water will be prejudicial to health. On this point the author cannot but think that the popular opinion is based on misinformation, although it is freely admitted that the Adirondack region is now extremely healthful and the State ought not to either do anything itself, nor permit anything to be done which would deteriorate it. The popular view, however, that the construction of reservoirs must necessarily produce unhealthful conditions is thus far not sustained by any considerable amount of well attested facts. Without wishing to reflect upon anybody in any way, shape or manner, the author is disposed to look upon such view as largely a fad. Indeed, he has taken special pains to study the question both in this country and abroad, and has thus far to learn of a case where well attested facts show that any considerable amount of ill health has been caused by properly constructed reservoirs.

In the Adirondack region, where at the heads of nearly all the lakes there are now extensive marsh areas, the conditions will be materially improved by cutting the timber and covering the marsh areas with water, the more especially when the new water surface is high enough to cover the entire marsh area, a condition which in the majority of cases may be easily attained. Moreover, the Adirondack lakes and ponds have at their sides mostly sand, gravel, boulder or natural rock beaches, on which the annual fluctuation can have absolutely no effect. The marsh areas are usually in the continuation of the valleys at the heads of the lakes. As just stated, as soon as we attain an elevation of about 1,800 feet, July is practically the only month without frost; but, the reservoirs will ordinarily be full or nearly full of water during July. It is mostly only in the cooler months of September and October that the conditions of run-off are such as to require their being greatly drawn down. There seems little reason to doubt, therefore, but that the effect of constructing the reservoirs will be, on the whole, to increase the healthfulness of the region by doing away with numerous marsh areas which are now, during the warm weather, possibly the source of malarial influences.

A striking illustration of how unreasonable public prejudice in the North Woods may be was afforded by the author's experience at Indian Lake in the fall of 1897. At that time investigations as to the foundation of the new Indian Lake dam were in process, and in order to expedite the study it was proposed to draw the water out of the lake. This fact becoming known, violent protests were made by people living several miles away, who urged that if the lake were drawn down there was certain to be serious sickness, diphtheria among other diseases being mentioned as likely to occur. Time was an element of importance and inasmuch as it would require at least ten days to draw the water to a level low enough to be of any special assistance in the

study in hand, it was finally left undrawn, the water surface of the lake remaining during the whole summer and fall of 1897 at about the crest of the original timber dam, or at about twelve feet above extreme low water. In spite, however, of the water not being drawn there was a great deal of sickness in the vicinity of Indian Lake in the fall of 1897, diphtheria especially attacking a large number of children. Certainly had the water actually been drawn, as originally proposed, no amount of argument would have availed to show that the drawing of the water was not responsible for the disease.

WHY NEW YORK IS THE EMPIRE STATE.

New York State is pre-eminent in position by virtue of being the only State resting on the ocean and at the same time well grounded on Great Lakes. From time immemorial Mohawk Valley has been the highway of commerce between the East and the West. If the proposed deep waterway connecting Great Lakes with the ocean is ever constructed, nature has, from the very beginning, predetermined two possible routes, both of which pass through the State of New York; one by way of Oswego-Mohawk valleys to tidewater, and the other by way of St. Lawrence-Champlain-Hudson valleys to tidewater. The former of these routes—that through Mohawk Valley—was the pathway from the East to the West when the white man first came. Here the Iroquois warriors journeyed back and forth, and here, where the Dutch patroons built with the fur trade the early beginnings of what is now a vast interstate commerce, is the great highway of to-day. At Rome, the highest point on the divide between Mohawk River and Great Lakes drainage, the surface of the ground is only 425 feet above tidewater. This is the lowest pass from Adirondacks to Alabama; all other lines of communication rise to much higher altitudes than this. Hence it was inevitable that New York State, by virtue of position alone, should become a great manufacturing State, and it is, therefore, strange that, with its vast water powers, manufacturing business should not have developed here far in excess of any other State. Let us see why the great water powers, indispensable to the development of great manufacturing interests, happen to be located on the direct line of greatest commercial activity.

The explanation is partly geological and partly topographical; or, if we consider topography as an outcome of geology, then the explanation is all geological.

THREE MAIN WATER CENTRES.

If we examine a contour map of the State, we easily observe that there are three high points or water centres, from which the water flows in all directions. The larger and most important of these is the elevated region known as Adirondacks, the highest

peaks of which rise to an altitude of over 5,000 feet. The second water centre includes Catskill mountains, where the highest points rise to an altitude of over 4,000 feet. The third is the elevated region in Cattaraugus, Allegany, and Steuben counties, where the highest points are at an elevation of about 3,500 feet. This may be designated as Allegany centre. The Adirondack water centre is separated from Catskill by the valley of Mohawk River, which receives drainage from both—West and East Canada creeks and other tributaries of Mohawk on the north side of the valley rising in Adirondack centre, while Schoharie Creek on the south side is an important tributary from Catskill centre.

In addition to Mohawk River other important streams of the State issuing from Adirondack centre are Black, Oswegatchie, Grass, Raquette, St. Regis, Chateaugay, Great Chazy, Saranac, Au Sable, Bouquet and Hudson Rivers.

From Catskill centre, in addition to Schoharie Creek, we find issuing the headwaters of Susquehanna, Delaware and Wallkill Rivers and Esopus Creek.

The Allegany centre supplies the headwaters of Cattaraugus Creek, Genesee, Chemung, Canisteo, Tioga, west branch of the Susquehanna and Allegany Rivers.

There are three other secondary water centres in the State, but for present purposes Adirondack, Catskill and Allegany centres may be considered the more important.

The Adirondack centre is a rugged region, consisting of primeval granitic rocks, interspersed with sand areas. Here appeared the first dry land on the Western Continent and thus was laid, in earliest geological time, the basis of those fine river systems which, issuing from this water centre, have created water powers of untold value to the citizens of New York. From the very beginning nature had foreordained the State of New York as the seat of future empire.

The geological history of Catskill and Allegany water centres is quite different. In both these regions the sedimentary sandstone rocks of Catskill and Chemung groups have attained their greatest development. In Catskill mountains these rocks are still almost absolutely horizontal, as originally deposited, and in places several thousand feet in thickness. Limestones and other hard rocks, underlaid by shales and soft formations, are found beneath the sandstones on lower stratigraphical horizons. This circumstance has determined, in the process of erosion, the great falls and rapids of Niagara River amounting to nearly 220 feet; the six falls and the intervening rapids of Genesee River at Portage and Rochester of about 750 feet; the high falls of Big Salmon River of 110 feet; Trenton Falls on West Canada Creek of 500 feet; Beardsley Falls and Cascades of East Canada Creek; the little and great falls of Mohawk; the falls of Oswego; Bakers Falls and Glens Falls of Hudson together with

many of the falls and rapids of Black River and other streams of the northern part of the State. In no State in the Union has nature worked out greater water power possibilities than in New York.

FUTURE DEVELOPMENT OF WATER-POWER IN NEW YORK.*

According to the United States censuses of 1870 and 1880 the total developed water power of the State of New York was, in 1870, 208,256 horse-power; in 1880, 219,348 horse-power; increase in the ten years, 11,092 horse-power. The increase in ten years of 11,092 horse-power is equivalent to an increase of 5.4 per cent. The United States census of 1890 did not include any statistics of water power, and it is impossible therefore to state definitely the horse-power in that year; still taking into account the great increase shown by the special investigations on Hudson River in 1895, on Genesee River in 1896, and at Niagara Falls in 1897, and also considering the advances in paper making—a water-power industry—as well as the great development now taking place at Massena, the increase for the whole State from 1880 to 1900 may be estimated at about 120 to 140 per cent. On this basis there will probably be in use in New York State at the close of the nineteenth century a total water power of something like 500,000 gross horse-power. The manufacture of mechanical wood pulp alone consumes about 125,000 gross horse-power. These figures, while very suggestive as to the future, are nevertheless rendered more pertinent by considering that with full development of the water-storage possibilities of the State as well as the possibilities of power development on Niagara and St. Lawrence Rivers, we may hope ultimately to reach a water-power development in the State of New York something like the following:

POSSIBLE DEVELOPMENT OF WATER-POWER IN NEW YORK.

	GROSS HORSE-POWER.
Streams tributary to Lake Erie,	3,000
Niagara River (in New York State),	350,000
Genesee River and tributaries,	65,000
Oswego River and tributaries,	40,000
Black River and tributaries,	120,000
Other tributaries of Lake Ontario,	10,000
St. Lawrence River,	400,000
Oswegatchie, Grass, Racket, St. Regis, Salmon, Chatagay, and other streams tributary to the St. Lawrence,	150,000
Saranac, Au Sable, Lake George outlet, and other streams tributary Lake Champlain,	40,000

* This chapter is abstracted from the author's report to the U. S. Geological Survey on The Water Resources of the State of New York, Papers Nos. 24 and 25 of the U. S. Geological Survey's Water Supply and Irrigation Papers.

POSSIBLE DEVELOPMENT OF WATER-POWER IN NEW YORK.

(Continued.)

	GROSS HORSE-POWER.
Hudson River and tributaries, not including Mohawk River,	210,000
Mohawk River and tributaries,	60,000
Streams tributary to Allegany River,	5,000
Streams tributary to Susquehanna River,	25,000
Streams tributary to Delaware River,	30,000
Water-power of Erie Canal,	10,000
Total,	1,518,000

But 1,518,000 gross horse-power has an effective productive value in manufacturing of say $100 per horse-power per annum, or the inland waters of this State have an ultimate economic value when fully developed, of at least $151,800,000 per annum. They may therefore be made, in producing capacity, substantially equal to the entire agricultural product of the State in 1890, which, according to the United States census of that year, amounted to a total of $161,593,009. Indeed, taking into account that agricultural values are continually depreciating, and water-power values appreciating, it is probable that ultimately, if New York State agriculture were to remain on the same basis as at present, the water-power values would considerably exceed the agricultural values. It is probable, however, if the manufacturing industries of this State are ever so far developed as to bring water-power into use to the extent of 1,518,000 gross horse-power, that the local demand for agricultural products will have considerably changed the present downward tendency. As an off-hand figure, we may, therefore, place these two values, at some not very distant date, as equal, and approximating about $200,000,000 per annum.

INCREASE IN DEVELOPED WATER-POWER IN NEW YORK.

In order to illustrate the increase in developed water-power in the State of New York for the last seventeen years we have the following table of increase on four rivers of the State.

RIVER	NET HORSE-POWER IN USE IN 1882	NET HORSE-POWER IN USE IN 1898	INCREASE IN SIXTEEN YEARS
Niagara,	2,650	45,000	42,350
Genesee,	6,880	19,180	12,300
Black,	13,000	50,000	37,000
Hudson,	12,900	52,000	39,100
Totals,	35,430	166,180	130,750

INDIAN RIVER DAM. UPPER SIDE.

WHY WATER-POWER DEVELOPMENT HAS BEEN BACKWARD IN NEW YORK.

The foregoing statistics of possible water development in the State of New York suggest the very pertinent questions, why with such natural resources and with the advantage of position the water power of the State has not been more fully utilized. The answer to this question involves consideration of certain State policies from early in the present century and which cannot be well discussed in detail at this time.* A few of the reasons for our backwardness in this particular are as follows:

LAWS OF RIPARIAN OWNERSHIP IN NEW YORK.

As a main reason why, in view of the superior natural advantages, the development of water power interests in the State of New York has been relatively backward, we may cite the curiously diverse views as to the law of riparian ownership which prevail in different parts of the State. On lower and middle Hudson River as well as in most of Mohawk Valley all original titles are derived from the laws of Holland as they existed early in the seventeenth century. Under the Dutch law the riparian proprietors owned neither the beds nor the banks of the streams, but both remained the property of the State. When the colony of New Netherlands passed into the hands of the English Government the colonists were assured the peaceful enjoyment of all the rights they then possessed. The beds of large streams never having been conveyed became then vested in the English Government as ungranted lands, to which as a consequence of the Revolutionary war the State of New York succeeded in due course.

The English common law, which became in force in the colony of New York after the English occupancy, differs from the civil law of Holland, in affirming the right of the riparian proprietors not only to the banks of non-navigable large streams, but also to the beds thereof, and hence to a right to the flow of the water paramount to that of the State, which can only acquire rights therein by the exercise of eminent domain and the granting of just compensation. This principle applies to all the streams of the State except lower and middle Hudson and Mohawk, as already stated.

COMPENSATION IN KIND ON BLACK RIVER.

On Black River still another view has prevailed. Generally the legislatures and courts of this country have been chary about recognizing the principle of compensation in kind, although in riparian matters this principle is common enough in England.

* For discussion in detail, see the author's paper: On the Application of the Principles of Forestry and Water Storage to the Mill Streams of the State of New York, read before the American Paper and Pulp Association at its Twenty-second Annual Meeting, 1899.

In the United States it has been almost universally held that when the State exercised the right of eminent domain the compensation could not be in kind but must be in current money of the realm. In 1851, however, when considerable volumes of water were diverted from Black River for the supply of Black River and Erie Canals, the Legislature passed an act providing for the construction of storage reservoirs on upper Black River in order to compensate in kind for water diverted from that stream for the supply of the canals. Successive acts relating to the same subject have been passed from time to time, until at the present there are a series of compensating reservoirs on the head waters of the main river and its two principal tributaries, Beaver and Moose, making a total storage of over 3,600,000,000 cubic feet. This particular case must be considered as to the advantage of the water powers and is merely cited as illustrating the curiously diverse and illogical practices which have governed the relation of the Commonwealth to the inland waters of this State. Its significance is accentuated when we consider that on Genesee River, where a considerable diversion for canal purposes has taken place ever since 1825, the riparian owners have not been compensated either by money or in kind, and State authorities have taken the ground that the State is entitled to the water of that stream by reason of a paramount right on the part of the State, which exists independent of and superior to the rights of the riparian owners. These various diverse practices have, undoubtedly, on the whole operated to the disadvantage of water power development in New York.

NO GENERAL MILL ACT IN NEW YORK.

Without special legislation private enterprise has been unable, by reason of there being no method of obtaining control of lands to be flooded for reservoirs, to develop power at any point where large areas were to be flooded, or where reservoirs were desired to be created. In the New England States, Virginia, Wisconsin and several others there are a series of enactments known as Mill Acts which, founded in the extension of the doctrine of eminent domain, have as their object the encouragement of the erection of mills. In Massachusetts, manufacturing has always been a chief occupation of the people, hence that State was one of the first to embody in its statutes a Mill Act, under the provisions of which manufacturers may exercise the right of eminent domain, acquiring by due process of law private property for the construction of storage reservoirs. The exercise of the prerogative of sovereignity for this purpose is justified on the ground of the common public good. But in New York, by reason of the State going into the transportation business, and consequently adopting the policy of conserving the inland streams for the use of its internal navigation system purely, it has resulted that no general Mill Act has ever been enacted.

The most that has been done in this State is to enact a series of special Mill Acts applying to individual streams, as, for instance, Oswegatchie, Great Chazy, Grass, Raquette, Saranac, Moose, Salmon and Chateaugay Rivers. These several acts were passed at various times from 1865 to 1877, inclusive. In 1898, a similar act, although on quite different lines from the preceding ones, was passed applying to Genesee River.

By the terms of the acts applying to Oswegatchie, Great Chazy, Grass and other rivers in the northern part of the State, Commissioners are appointed who may erect dams; and if possible, to agree on terms with the owners, purchase the necessary lands, taking the conveyance thereof to themselves and their assigns forever. If they cannot agree on the terms of purchase then title may be acquired under the general condemnation laws of the State.

In Genesee River Act of 1897 a private company is authorized to condemn lands for reservoir purposes, the State granting the right of eminent domain for such purpose in consideration of the public service performed by the company of checking floods and improving the sanitary condition of lower Genesee Valley, etc.

Summarizing this part of the subject, what is needed by the water power interests of this State is a uniformity of law applying alike to all the streams of the State, and the enactment of a broad general Mill Act which shall permit of developing water storage on any stream to its full capacity without any further powers from the Legislature than those granted in the general act.

THE PRINCIPLES OF WATER STORAGE.

We may now pass to a brief discussion of the principles governing water storage, the first item demanding consideration being the great variation in the natural flow of streams. In the spring, with the melting of the winter snows, every rivulet is swollen and streams which in August and September are either nearly or entirely dry become raging torrents. Frequently within a week an amount of water flows down the channels of the rivers in this State sufficient to maintain, if distributed uniformly throughout the year, enough water power to drive vast manufacturing establishments and furnish a livelihood for literally hundreds of thousands of people. To so regulate the flow of a stream by water storage as to cause it to flow uniformly throughout the whole year is, therefore, in effect to furnish sustenance for an increased population.

MAXIMUM AND MINIMUM FLOWS OF STREAMS.

By way of illustrating the range of the maximum and minimum flows of streams in the State of New York we may cite data from Genesee and Hudson Rivers, and other streams. In the great flood on Genesee in May, 1894, the maximum flow from a catchment area of 1,070 square miles was 42,000 cubic feet per second. The total discharge of the stream from 7 a.m. of May 19, 1894, to 7 a.m. of May 24, was, roundly, 6,900,000,000 cubic feet. At the rate of 1,000 cubic feet per second this quantity of water would have maintained the flow of the stream eighty days. Flood flows of from 25,000 to 35,000 cubic feet per second in upper Genesee are very common.

The minimum mean monthly flow of upper Genesee may be taken at 0.099 cubic feet per square mile per second. Occasionally, for a few days, it is probably as low as about 0.080 cubic feet per second. The following table gives the mean monthly flows for a catchment basin of 1,070 square miles as gaged at Mount Morris for the several low flow months of the year 1895, that year being a year of minimum flow on Genesee River:

MONTH	MEAN FLOW IN CUBIC FEET PER SEC.	CUBIC FEET PER SEC. PER SQ. MILE	INCHES ON THE WATERSHED
May,	174	0.163	0.19
June,	128	0.119	0.13
July,	105	0.099	0.11
August,	115	0.108	0.12
September,	100	0.093	0.10
October,	104	0.097	0.11

On Hudson River the maximum flow thus far observed, which occurred on April 19, 1896, was 59,400 cubic feet per second. Minimum flows of about 1,080 cubic feet per second have been observed for a few days on several occasions. Expressed in cubic feet per second per square mile, the maximum flow becomes 13.2 cubic feet per second per square mile, and the minimum 0.24 of a cubic foot per second per square mile. This latter figure, however, does not take into account the diversion for Champlain Canal, and when an addition is made covering this item, the observed minimum flow of the stream properly becomes 0.29 cubic feet per second per square mile. The following table gives the flow of Hudson River by months during the entire water year of 1895, in which year the flow was the least of any during the period covered by the gagings:

MONTH	YEAR	MEAN MONTHLY FLOW IN CUBIC FEET PER SEC.	MEAN MONTHLY FLOW IN INCHES ON THE WATERSHED
December,	1894	4,367	1.12
January,	1895	3,876	0.99
February,	1895	3,543	0.82
March,	1895	4,204	1.08
April,	1895	23,822	5.91
May,	1895	6,850	1.76
June,	1895	2,816	0.70
July,	1895	2,559	0.66
August,	1895	3,901	1.00
September,	1895	2,629	0.65
October,	1895	2,631	0.69
November,	1895	8,421	2.08
Yearly mean and total,		5,780	17.46

By way of further illustrating the variation in the monthly flows we may now consider the year 1892, which was the maximum water year of Hudson River gaging period:

MONTH	YEAR	MEAN MONTHLY FLOW IN CUBIC FEET PER SEC.	MEAN MONTHLY FLOW IN INCHES ON THE WATERSHED
December,	1891	8,577	2.27
January,	1892	18,857	4.83
February,	1892	9,263	2.22
March,	1892	10,929	2.80
April,	1892	21,554	5.35
May,	1892	19,622	5.03
June,	1892	12,395	3.08
July,	1892	9,287	2.38
August,	1892	5,485	1.41
September,	1892	4,448	1.10
October,	1892	2,819	0.72
November,	1892	7,604	1.89
Yearly mean and total,		10,909	33.08

The preceding tabulations show that on Hudson River the entire flow for the maximum year is about double the entire flow of the minimum year.

THE LIMIT OF MINIMUM FLOWS.

The Hudson River gagings show that the extreme minimum of 0.29 of a cubic foot per second per square mile has only occurred for two periods, one of six days and the other of five days—a total of eleven days for the whole period covered by the gagings. For the month of July, 1888, the mean flow may be taken at 0.37 of a cubic foot per second per square mile, and for October, 1891, the mean flow was 0.36 of a cubic foot per second per square mile. In July, 1890, the mean flow for the month was 0.43 of a cubic foot per second per square mile, and in several other months, as July, 1893; July, 1895; and September, 1895, the mean monthly flow varied from about 0.59 cubic feet per second per square mile to about 0.61 cubic feet per second per square mile. As a practical proposition it may be said, therefore, that while Hudson River remains in its present state—for any business where it is not absolutely indispensable to have permanent power—water-power may be developed up to the limit of about 0.4 of a cubic foot per second per square mile, with a fair prospect of not being stopped on account of low water more than a few days in each year. But for electric power, or any other application of water-power requiring an absolutely permanent power every day in the year, the development ought not to be based, under present conditions, on more than about 0.24 to 0.25 of a cubic foot per second per square mile, these latter figures relating specially to that portion of the river from which water is diverted for the supply of Champlain Canal.* At points above Glens Falls Feeder the indications are that permanent power developments may be made up to about 0.3 of a cubic foot per second per square mile. As a matter of fact, nearly every water-power on Hudson River is developed far beyond these figures, but under these conditions, some portion necessarily stands idle more or less during the low water period of each year. On Black River, due to the compensation storage, developments may be safely made up to about 0.40 of a cubic foot per second per square mile. If that river were more nearly in its natural state, the indications of the rainfall and run-off data are that the safe measure of development would be substantially the same as on Hudson.

WHAT A STORAGE PROPOSITION INVOLVES.

Broadly, a storage proposition involves the construction of large reservoirs in which the flood flows of what we distinctively call the storage period, which includes the months from December to May, inclusive, may be held back, to be fed out in such manner as to maintain an equable flow during the entire year. As already shown by

* During the early part of August, 1899, the flow has been somewhat lower than given in the foregoing. Without having the gaging record at hand the extreme observed minimum may be placed at about 0.20 of a cubic foot per square mile per second. The figures in the text relate to the observed minimum of the gaging period from October, 1887, to November, 1898, inclusive.

TUNNELS AND BUTTRESSES. LOWER SIDE.

the last tabulations, streams vary greatly in water yield in different years, such variation being in some degree proportional to rainfall. It is also proportional in different catchment areas to the ground water storage capacity of the soil. Sand areas and other porous soils hold back the water which falls upon the surface, while impervious clay soils allow it to quickly run off after each rainfall. Forest coverings also retard the run-off, producing a more equable flow.

THE DATA NEEDED.

In order to develop the storage capacity of any given stream to the greatest possible degree, it is necessary to have enough rainfall records, covering the precipitation at points either within or in the vicinity of the catchment basin of the stream, to insure a precise statement of the average monthly and annual rainfall of the basin. It is also indispensable to have a run-off record determined from several years' gagings. In order to place the determination of the flow line beyond all question the gagings should cover at least fifteen years. Whenever we work with much less length of gagings than about fifteen years there is always a chance for more or less serious error. Having the foregoing data as well as the area of the catchment basin, which can only be satisfactorily determined from a topographical map, we are prepared to compute the average line of flow to which the stream can be maintained, provided its upper reaches contain the required storage ground. There is no way of determining the height of dam for full development storage until these data are at hand.

RESULTS ON GENESEE AND HUDSON RIVERS.

By way of illustrating practical results in this direction, it may be pointed out that on Genesee River, with rainfalls and run-offs as per tabulations herein contained, and with a drainage area of 1,000 square miles above the point where the proposed storage is to be made, the mean flow fixed upon at Rochester, where the drainage area is 2,365 square miles, is 1,080 cubic feet per second during the months from May to November, inclusive, and 1,000 cubic feet per second for the balance of the year, the additional 80 cubic feet of the summer months being the amount of water required by Erie Canal during that period. The proposed regulation, therefore, is on the basis of 1,000 cubic feet per second for the entire year for the manufacturing interests, or, taking into account that the minimum flow of the stream in its present, natural, unregulated condition is 200 cubic feet per second, the result of constructing the proposed storage will be to increase the minimum flow permanently to five times the present figure. It is estimated that this result can be attained on Genesee River for an initial expenditure of $2,600,000. The capacity of the storage reservoir to be

constructed is 15,000,000,000 cubic feet. The reservoir required to furnish this storage will be nearly fifteen miles in length, an average of about a mile in width and will have an average depth of sixty feet, the depth at the lower end being 118 feet.

On Hudson River extensive surveys have been made for the construction of a reservoir system on the headwaters of that stream. The work has been carried far enough to indicate that a storage of about 44,000,000,000 cubic feet can be made at an estimated cost of $2,606,000. In regard to this estimated cost it may be stated that a portion of the data was somewhat general and it is possible that the final figures when obtained may indicate a cost somewhat above $3,000,000. In any case, however, the cost of the storage of Hudson River is relatively low and would be a good investment for the riparian owners, even though it were to cost considerably more than $3,000,000. By way of illustrating this latter proposition it may be cited that the estimated cost of Genesee River storage is $173 per million cubic feet stored, while on Hudson the estimated cost at $3,000,000 expenditure for a storage of 44,000,000,000 is only $68.18 per million cubic feet stored. At the figure of $173 per million cubic feet stored, Genesee River project is considered to be good, commercially, and a private corporation has been chartered and organized for the purpose of constructing the work, the income of such corporation to be derived from the sale of the stored water. If such a project is commercially practicable on Genesee River, much more would it be so on Hudson.

WHAT CONSTITUTES THE BEST NATURAL MILL STREAMS.

The value of artificial water storage is strongly brought out when we consider that the best mill streams are those with lake storage. For example, in New York, Oswego, Black, Mohawk, Hudson, Oswegatchie, Raquette, Grass, Saranac, Au Sable, and other inland streams with large lakes at their headwaters are easily the best mill streams of the State, the reason being that the temporary storage of the lake surfaces has realized in some degree the benefits which would accrue in a much larger degree if those lakes were all converted into storage reservoirs up to the full limit of their capacity. In this connection we may mention Niagara River, which has the largest storage of all. The Great Lakes, with a surface area above Niagara River of 87,700 square miles, are in effect a vast storage reservoir which practically regulates the flow of Niagara River to substantial uniformity. Recent measurements indicate a mean flow of about 230,000 cubic feet per second, which may be expected to vary from a minimum of perhaps 150,000 cubic feet per second to a maximum of 300,000 cubic feet per second, a much smaller range than that of any of the inland streams of the State, the less range being due entirely to the great equalizing effect of Great Lake storage reservoir.

The conditions on Mohawk River may also be specially mentioned. The main tributaries of this stream from the north are East and West Canada Creeks, which both have large natural lake storage with a consequent low water flow of at least 0.3 of a cubic foot per second per square mile. The main tributary from the South is Schoharie Creek, which has no natural lake storage and which runs down in dry weather to less than 0.1 of a cubic foot per second per square mile. In both cases the surface slopes are steep and a considerable part of the variation in low water flow is due to differences in natural storage conditions. However, the fact that Schoharie Creek catchment area is deforested, while Canada creeks' areas are still largely in forest, as well as differences in surface geology, may be taken into account. Nevertheless, when all proper allowances of this sort are made, it still remains true that the differences in surface storage are contributing causes to the differences in value of these creeks in their natural state as mill streams.

WATER STORAGE SYSTEMS FOR THE CONSERVATION OF WATER-POWER COMMON IN THE EASTERN UNITED STATES.

Storage projects with reference to conserving the flood water of the winter and spring season in order to foster water-power interests have probably been as extensively inaugurated in the United States as anywhere. In foreign countries many vast reservings have been created for storing water for irrigation, and for checking floods in mountain streams, but aside from a few cases in France, Belgium and Germany the vast foreign constructions of this character have not generally been for the benefit of manufacturing. In Massachusetts, Connecticut, Maine and New Hampshire, however, under the fostering care of rational Mill Acts, reservoirs for water-power purposes alone have been very extensively constructed. Especially is this true in Massachusetts and Connecticut, where practically every stream has its storage reservoir, with the result that the mill streams of those two States may be estimated to be yielding to-day anywhere from 200 to 300 per cent. more power than they could be made to yield if left in their natural unregulated state. Possibly the percentage of increase is considerably higher than this, but in the absence of detailed statistics it is desired to state it conservatively. There can be no question but that the increase is at least as great as 200 per cent.

WATER STORAGE IN NEW YORK.

Even in the State of New York, where, as shown in the foregoing, we are, considering our natural advantages, somewhat backward, still, from another point of view, we have accomplished a good deal. The reservoirs constructed under the special

Mill Acts of twenty to thirty years ago on Oswegatchie and other streams of the northern Adirondack region have been of considerable value to the water-power interests of those streams. The Cranberry Lake reservoir of this series is of considerable extent, and, while no figures as to the increase of flow have been kept, it may still be safely stated as having materially increased the summer flow. Unfortunately, the Commissioners for these reservoirs did not realize the importance of taking the matter up in a scientific manner, and the dams were not only cheaply constructed, but were made entirely without reference to the fundamental data of rainfall and run-off in relation to catchment area. As the result of the cheap and temporary character of some of the dams they have been allowed to fall into decay and the reservoirs are now practically out of existence, not because they were not of value, but because the parties managing the affair did not know how to do the thing which they set about doing. It is to be hoped that the increase of the scientific spirit will prevent further erroneous practice on this line in the State of New York.

BLACK RIVER RESERVOIR SYSTEM.

Thus far Genesee and Hudson Rivers are the only streams in New York that have been thoroughly studied with reference to storage possibilities. Something has, however, been done on Black River, and since that stream presents an exceedingly interesting case, because of the adoption there, by the State, of the principle of compensation in kind, we will consider the main points of Black River reservoir system as it exists at the present time.

The ordinary diversion from Black River for the water supply of Black River and Erie Canals is as per the following table:

MONTH.	DIVERSION IN CUBIC FEET PER SECOND.
May,	183
June,	201
July,	216
August,	209
September,	183
October,	164
November,	130
Mean,	184

The following are the reservoirs which have been constructed by the State in order to make good this diversion:

NAME OF RESERVOIR	APPROXIMATE AREA. IN ACRES	APPROXIMATE MEAN DEPTH. IN FEET	APPROXIMATE AND AVAILABLE CAPACITY. IN CUBIC FEET
White Lake,	296	5	64,000,000
Chub Lake,	200	4	35,000,000
Sand Lake,	306	15	200,000,000
Woodhull Lake,	1,118	18	438,000,000
Bisbys Lakes,	....	3.5	40,000,000
Canachagala Lake,	320	4	56,000,000
North Lake,	277	28	676,000,000
South Lake,	372	26	350,000,000
Twin Lakes,	175	8	60,000,000
Fulton Chain Lakes,	....	..	800,000,000
Forestport,	700	10	300,000,000
Stillwater,	1,675	9	658,000,000
Total,			3,677,000,000

In addition to the foregoing, opportunities for storage systems exist on West and East Canada creeks, tributaries of Mohawk, and on all the streams of Adirondack water center tributary to St. Lawrence River and Lake Champlain. These latter, however, have never been systematically worked up and little can be said of them in detail. An available site is also found on Salmon River in Oswego county, as well as in the broad valley of lower Black River above Carthage where there is an elegant site permitting of developing the full capacity of the stream to the extent of perhaps 40,000,000,000 to 50,000,000,000 cubic feet. The Delaware, Susquehanna and Allegany Rivers and other streams of the southern tier do not generally permit of developing large storage systems, although undoubtedly detailed study would lead to the discovery of a few available sites, which would probably be more expensive per unit of storage than on the streams to the north.

THE NECESSARY CONDITIONS.

The necessary conditions for applying the principles of storage to mill streams are (1), the existence of either broad, nearly level valleys with narrow throats at the lower ends, or of natural ponds and lakes of considerable area with such throats; (2), these broad, level valleys, ponds and lakes must have enough tributary catchment area above them to insure the inflow of large volumes of water to be stored; and (3), the narrow

throats at the lower ends should show rock foundations either at the surface of the ground, or at moderate depths in order that substantial masonry dams may be built. Thus far most of the storage projects for the benefit of the water-power interests carried out in New York have been marred somewhat by the construction of temporary wooden structures, which require considerable expenditure for repairs every few years. This mistake has led, as pointed out on a previous page, to the abandonment of some of the early reservoirs. In New England, where experience in the construction of dams is more extensive than elsewhere in the United States, important barrage works are now made chiefly of stone, but in New York the use of temporary timber structures is still much too common. This is the more astonishing because if a timber dam is well built it is apt to cost about as much as masonry. Usually, when we take into account first cost, repairs, renewals and the fixed charges generally, it will turn out that masonry structures—although generally more expensive in first cost—are the cheapest in the end.

HUDSON RIVER RESERVOIR SYSTEM.

We may now describe Hudson River with special reference to the proposed reservoir system on the headwaters of that stream.*

Chapter 599 of the Laws of New York of 1895 directed that the State Engineer and Surveyor, acting in conjunction with the Superintendent of Public Works, should, as soon as practicable, make a survey of upper Hudson valley in order to determine what lakes, ponds and river valleys could be improved by the construction of storage dams in order to provide additional water for:

(1) The use of Champlain Canal.

(2) For restoring to the water-power of Hudson River water diverted for canal purposes.

(3) Water for improving the navigation of lower Hudson River.

The main branches of Hudson River rise in the elevated mountain region of Essex and Hamilton counties. The whole region is rugged and mountainous, and was originally covered with heavy forests. The forest area has, however, been considerably reduced by lumbering operations in the last forty or fifty years, and by severe forest fires which have in places run over very extensive areas. Aside from a considerable summer population of tourists, the whole upper Hudson valley is sparsely populated, there being little opportunity for farming. The occupation of the great bulk of the people is lumbering. The cleared area is in consequence only a small per cent. of the whole.

* This description of Hudson River basin is condensed from a paper on Indian River Dam in "Engineering News" for May 18, 1899.

The extreme headwaters of Hudson River in Essex county drain from the southern slope of the highest mountains of the State, viz.: Mount Marcy, 5,344 feet; Mount McIntyre, 5,112 feet; Mount Skylight, 4,920 feet; Nipple Top, 4,620 feet; Dix Mountain, 4,842. This is a wild, uninhabited region of mountains, forests and lakes. The branches of Hudson to the west, Cedar and Indian Rivers, etc., drain a nearly equally wild, very sparsely inhabited country, but of somewhat less altitude, Snowy Mountain, the principal peak of the Indian Lake region, being somewhat over 4,000 feet above tide.

The upper Hudson valley may be considered as beginning at the mouth of Mohawk, tidewater having, previous to the construction of Troy dam, reached that point. The catchment area above the mouth of Mohawk is 4,627 square miles, and above Glens Falls, where the upper valley may more properly be taken to begin, it is 2,800 square miles.

The main tributaries of Hudson above Mohawk are Hoosic, with a drainage area of 711 square miles; Batten Kill, 438 square miles; Sacundaga, 1,057 square miles; Schroon, 570 square miles. Very little is known as to the rainfall of upper Hudson area from observations taken within the basin, the following being the only stations actually within the catchment area, and these are all in the southern part, South Hartford and Gloversville being just on the boundary:

Glens Falls.—Elevation, 340 feet above tide; average rainfall for twenty years, 37.76 inches.

Kings Station.—Elevation, 588 feet; average rainfall for eight years, 45.24 inches.

South Hartford.—Elevation 500 feet; average rainfall for thirteen years, 40.65 inches.

Gloversville.—Elevation, 850 feet; average rainfall for six years, 46.10 inches.

Keene Valley (a short distance north of the north end of the upper Hudson catchment area).—Elevation, 1,000 feet; average rainfall for eighteen years, 35.93 inches.

Saranac Lake (also a short distance north of the Hudson catchment area).—Elevation, 1,540 feet; average rainfall for six years, 37.90 inches.

Waterford (near Troy).—Elevation, 50 feet; average rainfall for four years, given as 36.62 inches.

Albany.—Elevation, 97 feet; average rainfall for seventy-three years, 39.38 inches.

In discussing questions relating to rainfall in upper Hudson catchment area, it has been the author's custom to take as best applying to the entire basin the rainfall of Northern Plateau as used by the State Meteorological Bureau, the stations included therein being Elizabethtown, Keene Valley, Lake Placid, Saranac Lake, Gloversville, Little Falls, North Lake, Lowville, Number Four and Kings Station. The monthly means derived from taking the averages at all these stations is considered to give a very close approximation to the mean monthly rainfall of upper Hudson area. The figures for the eleven year period from 1888 to 1898, inclusive, may be found in the author's paper, Data of Stream Flow in Relation to Forests.

The studies of the possibilities of water storage in Adirondack region indicate that reservoirs may be made on lakes and in river valleys of upper Hudson catchment area with a total storage of over 44,000,000,000 cubic feet. Probably when the investigation is fully complete this figure will be considerably increased, but just how much cannot now be stated for lack of the definite data to be drawn from topographical surveys. The investigations made in 1895–6 showed that, taking into account the distribution and quantity of rainfall, reservoirs could be safely constructed in upper Hudson catchment area storing 13.5 ins. over the entire area. The argument on which this conclusion is based may be found in the author's report on upper Hudson surveys made to the State Engineer and Surveyor under date of December 31, 1895, and published as an appendix to the annual report of the State Engineer and Surveyor for the year ending September 30, 1895. The investigations made also showed that, generally speaking, reservoirs could be constructed in the Adirondack region much cheaper than in other parts of the State of New York. The original estimated cost of a system of small reservoirs for Schroon valley is $1,172,500, which gives, for a total storage of 15,330,000,000 cubic feet, a cost per million cubic feet stored of $76.48. Or a single reservoir may be constructed, storing on Schroon and Brant Lakes a total of 15,925,000,000 cubic feet, at an approximate cost of $840,000, or at $52.12 per million cubic feet stored. At Piseco Lake it was estimated that a storage of 1,725,000,000 cubic feet could be made for $70,000, or for $40 per million cubic feet stored. At Indian Lake it was estimated that a storage of 4,468,000,000 cubic feet could be made for $120,000, or at the rate of $26.86 per million cubic feet stored. As will be shown farther on, the actual construction just completed at Indian Lake has abundantly justified the original estimate, although it is believed from additional information gained by the surveys of 1896 that some of the other reservoirs were underestimated and that moderate corrections in the figures should be made. Even when such corrections are made, it still remains true that water storage in Adirondack region can be made much cheaper than in any other portion of the State of New York.

INDIAN LAKE. FROM FARRINGTON'S.

(CLEARING FOR THE NEW FLOW LINE MAY BE SEEN IN THE DISTANCE ON THE LEFT-HAND SHORE.)

The following tabulation gives the proposed reservoirs of Hudson system so far as the data have been worked up:

LOCATION ON WHAT STREAM OR TRIBUTARY	NAME OF RESERVOIR	ESTIMATED CAPACITY. IN CUBIC FEET	TRIBUTARY CATCHMENT AREA. IN SQ. MILES
Sacundaga River,	Conklinville,	4,000,000,000	900
Sacundaga River,	Lake Pleasant,	1,400,000,000	45
Sacundaga River,	Piseco Lake,	1,725,000,000	55
Sacundaga River,	Arietta Flow,	1,400,000,000	40
Main North River,	Thirteenth Pond,	439,000,000	14
Main North River,	Chain Lakes,	1,819,000,000	58
Main North River,	Catlin Lake,	784,000,000	25
Main North River,	Lakes Rich, Harris and Newcomb and Goodenow Flow,	2,603,000,000	83
Main North River,	Lake Henderson,	565,000,000	18
Main North River,	Tahawus Flow,	2,101,000,000	67
Boreas River,	Boreas and Cheney Ponds,	1,411,000,000	45
Cedar River,	Wakely Flow,	1,819,000,000	58
Indian River,	Indian Lake,	5,000,000,000	146
Schroon River,	Tumblehead Falls,	16,000,000,000	502
Main North River,	Hadley,	4,000,000,000	580
Total,		44,066,000,000	

INDIAN LAKE RESERVOIR.

The preliminary investigations having shown that a large reservoir could be made at Indian Lake very cheaply, The Indian River Company, a corporation composed of owners and users of water-power on Hudson River, was organized in 1897 to develop the storage of this lake to full capacity in order to help out the low water flow of Hudson River. There are several novel features of the substantial masonry dam constructed which merit brief description, especially when the large storage gained by moderate expenditure is taken into account. The dam creates an effective storage on Indian Lake of about 4,468,000,000 cubic feet up to the level of the spillway crest, or, if we admit the use of flash boards one to two feet in height, a storage may be expected of, roundly, 5,000,000,000 cubic feet *

Lumbering operations began in the vicinity of Indian Lake about 1845, in which year a dam was erected, which has been maintained continuously ever since, for the purpose of furnishing water for driving logs. The original dam raised the water surface between five and six feet; this was subsequently increased in rebuilding the

* Condensed from the paper on The Indian River Dam in "Engineering News."

dam to between ten and eleven feet. The lake itself (before these constructions were made) was about two miles in length and from 1,500 to 1,800 feet in width at the widest portion. The effect of raising the water ten feet was to make a body of water over nine miles in length, three-quarters of a mile wide at the widest portion, there being extensive low swamp areas at the upper end of the lake, which were flooded by the rise of ten feet. The present construction raises the water twenty-three feet above the crest of the old timber dam, or between thirty-three and thirty-four feet above the mean surface of the original lake, and overflows additional flat areas at the upper end of the lake to such an extent as to make a body of water 14.3 miles in length, with two bays with lengths of two miles and three and three-quarter miles, respectively. The drainage area tributary to the lake above the dam is 146 square miles. At the original raising of the water in 1845 the timber was left standing on the flat areas flooded, as was also done when later on the original dam was rebuilt and raised to an additional height. After two or three years this timber died and remained standing for many years, a serious blot on the landscape. About fifteen years ago the great bulk of it had fallen down, and since that time, aside from a few scattering stubs here and there, the old reservoir when full has presented the appearance of a fine, natural lake. Generally, the shores above the new flow line created by the ten-foot rise are bold and rocky, so that aside from an arm about 7.5 miles in length extending up Jessups River, one of the main tributaries, there is very little flat land to be flooded by the new construction. The new work has included the cutting of all the timber around the margins up to the new flow line, the total length, including Jessups River, being about thirty-five miles.

The area of Indian Lake proper (the original lake) is about 1,000 acres. The area at level of crest of old timber dam is 3,007 acres. The area at twenty-three feet above the old timber dam, or at the new flow line, is 4,075 acres.

The storage of the timber dam, which has been replaced by the new masonry dam, is estimated at 800,000,000 cubic feet.

THE ADIRONDACK PARK.

For a number of years public opinion in the State of New York has been rapidly focusing upon State ownership of the wild Adirondack area as the proper place for a great State park. As bearing in this direction the Legislature, in 1893, passed an act erecting Adirondack Park and defining its limits. This act provided that the park so created—

> Shall be forever reserved, maintained and cared for as ground open for the free use of all the people for their health and pleasure, and as forest lands necessary to the preservation of the headwaters of the chief rivers of the State, and the future timber supply, and shall remain part of the Forest Preserve.

The Adirondack Park, as defined by the Act of 1893, has an area of about 3,000,000 acres, of which the State had possession from tax titles, etc., in 1897, of about 661,000 acres. Governor Black, recognizing the importance of adopting a definite and comprehensive plan which should conserve the future water and timber supply of the State as contemplated in Adirondack Park Act of 1893, recommended in his annual message to the Legislature of 1897 the passage of "An act to provide for the acquisition of land in the territory embraced in Adirondack Park, and making an appropriation therefor." Under this act $1,000,000 was appropriated in 1897 and $500,000 in 1898. It is expected that the Legislature of 1899 will appropriate $300,000.

This act also created the Forest Preserve Board, to consist of three persons selected from the Commissioners of Fisheries, Game and Forest and the Commissioners of the Land Office. This board may enter upon and take possession of any land, structures and waters in the territory embraced in Adirondack Park, the appropriation of which in its judgment shall be necessary for the purposes specified in the act of 1893. The first Commissioners appointed were Timothy L. Woodruff, Lieutenant-Governor; Campbell W. Adams, State Engineer and Surveyor; and Charles H. Babcock, member of the Fisheries, Game and Forest Commission. The Commission still remains as originally constituted, except that E. A. Bond, State Engineer and Surveyor, has succeeded Campbell W. Adams, whose term expired December 31, 1898.

The old timber dam at foot of Indian Lake being badly in need of repair the owners thereof proposed, in the spring of 1897, to rebuild the same. While making arrangements looking toward such rebuilding it was found that Forest Preserve Board desired to acquire Township 15 and 32 in the Totten and Crossfield purchase, within the limits of which Indian Lake is situated. The reason for this purchase was that the State already had considerable holdings in that vicinity and bordering on these two townships, and in consequence their purchase would make a very extensive body of State lands in that vicinity. In its first annual report, transmitted to the Governor on January 29, 1898, Forest Preserve Board makes the following statements in regard to purchase of the lands at and about Indian Lake:

The largest acreage bought of any one party was that in Townships 15 and 32, Totten and Crossfield purchase, Hamilton county, which was purchased from The Indian River Company. This purchase included, with the exception of a few small lots previously sold to other parties, all of Township 15, and three-fourths of Township 32; in all, 42,000 acres. The price paid was $164,000, or $3.90 per acre. These lands include the shores of Indian Lake, and the dam at its outlet. The lake is over eleven miles in length. Originally it was much smaller, about three miles long; but a dam, built at its outlet, raised the water until the backflow extended its surface to its present area. As the dam was built many years ago, the trees around the shore of the lake which were then killed by the overflow, had gone out over the dam. The wooded

growth along the shore has adjusted itself to the changed conditions, leaving nothing in sight to indicate that the present boundaries of this beautiful lake were not the original ones. But if the dam, which was a wooden one, should be allowed to decay and fall to pieces, the water would be drawn down to its former level, reducing the lake to one-third its present size, and leaving miles of devastated flats. In 1893, the Forest Commission, in its annual report said:

"The beauty of this lake and its present area is dependent on the dam at its outlet. The damage and unsightly views once caused by it are matters of the past. If the dam were destroyed and the water allowed to fall, the upper portion of the lake would be changed into a dismal swamp, interspersed with slimy pools and rotting stumps. Now that the dam has been built, and the scenery has recovered from its ffects, it should be maintained at its present height. If this can be done in no other way, the State should do it at public expense. It would furnish an immense reservoir for the Hudson, and any variation in depth incidental to reservoir purposes would in no way affect the beauty of the steep banks."

At the time the Board purchased this tract of land, a contract had been made by the owners for the construction of a permanent stone dam to replace the decaying wooden one, and the price finally agreed upon was based upon a consideration of the advantages gained in thus not only preventing the destruction of Indian Lake in all its beauty, but also in preserving it as a vast reservoir for supplying the Champlain Canal, and improving the navigation of the Hudson River.

It is to be noted in this connection that the control of the flow of the waters has been thus secured to the State rather than left in the hands of private parties.

The permanent stone dam referred to by Forest Preserve Board in the foregoing quotation as the one for the construction of which a contract had been made, is the new dam herewith described, the Board's authority for such purchase being derived from Section 3 of the act creating Forest Preserve Board, which empowers them to enter on and take possession of any land, structures and waters in the territory embraced in the Adirondack Park, etc. It will be patent to any person giving the subject even casual consideration that the portion of Adirondack region included in Adirondack Park is, aside from forestry, of value for only two purposes, viz.: For a State park worthy of the great Commonwealth of New York, and for the conservation of the issuing streams by the construction of large storage reservoirs. It is highly creditable to Forest Preserve Board that it has been possible for it to inaugurate these two great enterprises, both of which are certain to be of the greatest possible value to the citizens of New York. The park and storage reservoirs are in the line of fully utilizing this region for the only things, aside from forestry, for which it is really useful.

CLEARING THE RESERVOIR MARGIN.

The specifications for clearing the reservoir margin provide:

That all timber and brush of every sort, kind and description now standing on the banks of the Indian River or Lake, above the site of the proposed dam, and between the present margins of the said river and lake and a line * * vertically above the new flow line, shall be cut to within two or three feet of the ground and thoroughly burned or

disposed of by cutting into logs, firewood or other merchantable timber. * * * * The limit of the clearing will be staked out by the engineer, and the contractor must carefully preserve all stakes set to indicate said limits. In any case, all the timber included within the limit included by the stakes will be considered the property of the contractor, but any of it which he wishes to utilize or save must be entirely removed beyond the limits of the work before the expiration of the contract. All timber not so excepted by the contractor and removed by him must be piled in proper windrows and completely burned. In general the area on which the said timber is situated is on side hill slopes and the timber may be conveniently windrowed down the hill toward the water. * * * Along the line of the new margin as wide a space as possible must be cleared of timber, tree tops, brush, etc., and at least four furrows plowed to prevent the spreading of fire. In any case, the contractor will use all and every precaution against the spreading of fire during the period of burning, and any damage which may be caused by the fire spreading into adjoining areas must be borne by him.

The burning, so far as carried, has been accomplished without damage to the adjoining forest. One outcome of the work was to show that it is exceedingly difficult to burn the bodies of the trees. Whenever this was attempted a mass of fire was made which held for several days, and was very liable to run outside the limits of the clearing whenever the wind blew strongly from off the lake. This point being satisfactorily determined by several trials, certain slight modifications of the specifications were made. Among others it was concluded better to not attempt to burn the heavy timber, but rather to, so far as possible, float it out after the reservoir has become full. The brush and tree tops, on the contrary, were easily burned, they making a quick fire which burned itself out very soon after being started. These points are referred to in somewhat greater detail in the accompanying special account of the clearing.

It has seemed proper to the author to go into this matter of the methods used and results obtained in clearing the margins somewhat more extensively than would otherwise have been done because, so far as known to him, no such extended clearing of a reservoir margin in the forest area has been previously carried out in this State. Generally those citizens who go to the woods for health and pleasure have justly considered the leaving of the standing timber about the margins of new reservoirs a great detriment, and in order to meet the natural opposition of those holding this view every attempt has been made to have the clearing at Indian Lake well done. The non-completion of the burning during the year 1898 is due entirely to the fact of constant rains during the months of October and November, in which months it would have otherwise been completed.

THE CLEARING OF THE TIMBER WITHIN THE FLOW LINE OF THE INDIAN LAKE RESERVOIR.*

Indian Lake was originally surrounded by heavy pine and spruce timber, reaching to the water's edge. In the original enlargement the flooded area was not cleared before submergence, but in undertaking the construction of the present masonry dam the plans included the clearing of the flooded area of all standing timber. This was done in deference to the views of people spending the summer in that vicinity, as a matter of pure æsthetics.

The area of the new flowage was mostly covered with hard and softwood timber —chiefly small spruce and balsam, birch and beech, ash, elm, maple and poplar. The softwood, of commercial size, has long since been cut very closely from the lake margin, in consequence of which the larger trees were chiefly hardwood, which does not float, and which cannot, therefore, be rafted down stream to sawmills and converted into lumber. The problems presented in clearing this area of timber, which was surrounded by very extended forests, were not only somewhat out of the usual line of ordinary engineering experience, but they must necessarily be repeated, in a large measure, in any future construction of reservoirs of considerable magnitude in the great water-gathering ground of the Adirondack region.

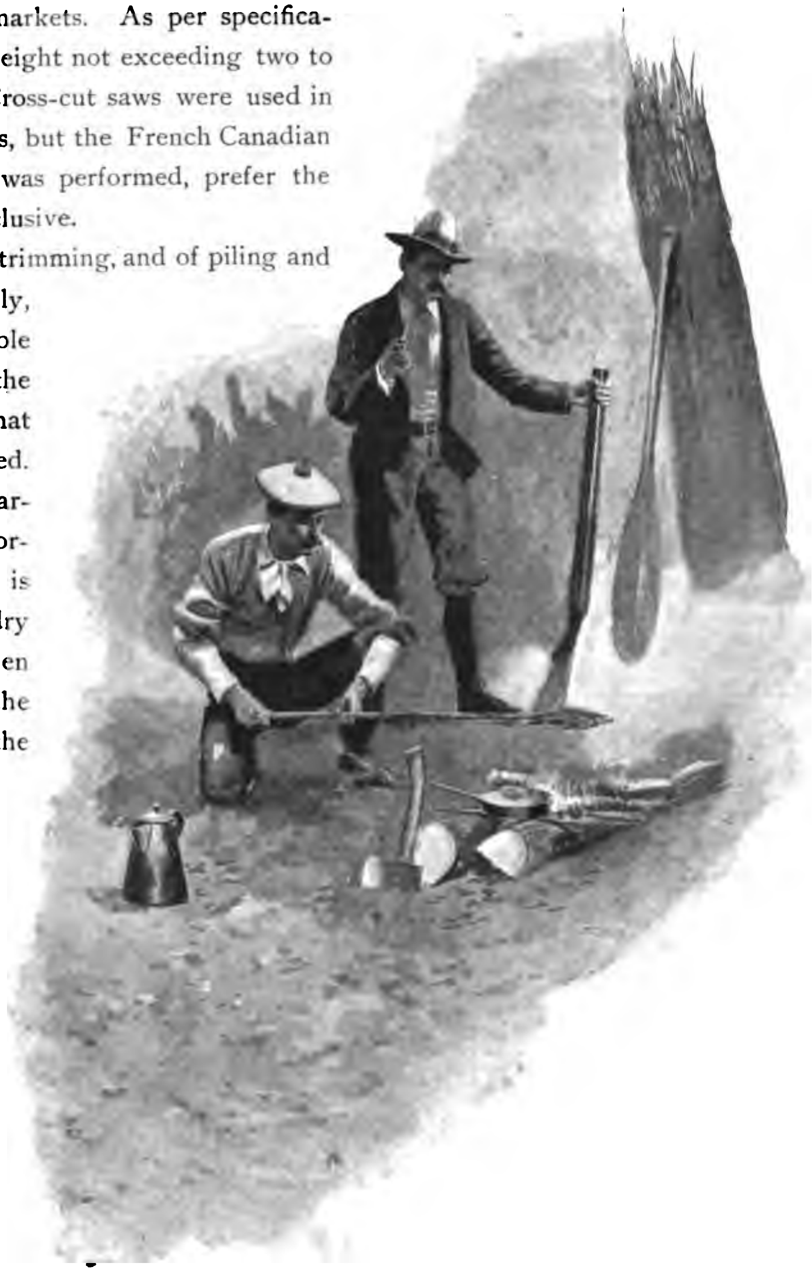
The contract price bid for cutting and burning was $13.50 per acre, which was rather low. Hence, from the contractor's point of view it was necessary for economic reasons that the work of clearing be done cheaply. This, as finally worked out, included in substance (1) felling the trees; (2) the severing of the larger limbs from the trunks, and trimming to such size as to admit of piling and burning; (3) the cutting of the trunks of the trees into suitable lengths either for piling and burning, or for sluicing through the logways provided in the dam; (4) the branches, underbrush and smaller trees to be in any case piled and burned. The method finally adopted for disposing of the larger trunks or bodies of the trees is substantially as follows: After cutting into proper lengths for burning the brush, etc., the large trunks are to be left until the reservoir is completed and filled, after which the hardwood and softwood logs will separate, the former remaining at the bottom and out of the way, while the floating soft wood will be rafted down the lake and sluiced through the dam in the same manner as logs intended for lumber, after which it may be allowed to take care of itself as driftwood in the stream channel below. As to the propriety of throwing a large amount of driftwood into the channel, it may be pointed out that all such is caught at the big boom above Glens Falls and cut into firewood for the Glen Falls,

---

*** The following detailed account of the work of clearing at Indian Lake has been prepared by Robert E. Horton, who was second assistant on the work.**

Sandy Hill and Fort Edwards markets. As per specifications, the trees were cut at a height not exceeding two to three feet above the ground. Cross-cut saws were used in the beginning for felling the trees, but the French Canadian woodsmen, by whom the labor was performed, prefer the axe, and its use soon became exclusive.

The operations of felling and trimming, and of piling and burning were carried on separately, and as much time as possible allowed to elapse between the felling and burning in order that the timber might become seasoned. Burning could be successfully carried on only under the most favorable conditions of weather, that is to say, when it was sufficiently dry and the wind favorable. When unfavorable conditions prevailed the force employed on this part of the work was kept busy piling brush.



AN ADIRONDACK CHEF.

As to the advantage of leaving the fallen timber to season before burning, it may be remarked that for some kinds of timber it is of doubtful advantage, especially when one considers that labor can be saved if the trimming, piling and burning are done as fast as the timber is felled. Under this head it may be pointed out that spruce and balsam burn readily when freshly cut, and hardwoods can be so burned if the brush is in closely compacted piles, especially if felled during the winter months when the sap is out, although heavy snow in Indian Lake region may interfere at this season. Again, a portion of Indian Lake flowage has been devastated by forest fires, and on such areas and in places where the original growth has been thinned by

lumbering operations, we frequently find a vigorous second growth of poplar and paper birch. Both these woods burn readily when first cut, but if left lying on the ground soon become water-soaked, and in consequence exceedingly difficult to burn.

Certain practical difficulties arose in the operation of burning, such as the preventing of injury to the adjacent forest, on which point the Forest Preserve Board was strongly insistent, the work being frequently inspected by Col. William F. Fox, Superintendent of Forests, and carried on under the daily supervision of a State fire-warden. The difficulties encountered under this head were at times quite serious, the fire frequently escaping into the forest, but happily without damage. The difficulties of burning the brush and smaller trees might be classified as follows: First, on islands lying entirely below the level of the new flow line. These could be burned very easily and rapidly, as there was no danger of the fire spreading. The area thus classified is, however, comparatively small, aggregating not more than fifty acres; this was largely burned over in a single day. The second class included narrow, steep lake margins, and the shores of islands having summits above the new flow line, on which summit the timber was left standing. These narrow lake and island margins constituted the larger portion of the flowage, and having an average slope upward from the water's edge of about one in ten. For the narrower parts of the lake margin the slope was steeper in proportion, varying from almost perfectly flat areas to nearly vertical. It was found early in the work that the problem of burning the narrow margins was one of considerable difficulty. The open side toward the water gave free access to the landward winds from the lake, which, together with the natural tendency of the fire to creep up the slope, made it very difficult in places to prevent the fire entering the forest. However, it was found that, except under very favorable conditions, the fire, generally speaking, would smother out in the forest as soon as it ran beyond the reach of the lake breeze. Nevertheless, it was very desirable, since Indian Lake is a pleasure resort during the summer, that the trees immediately bordering the new margin should be uninjured.

The difficulty of burning the margin varied greatly with the character of the timber. On softwood areas the ground is often covered with spruce-duff to a depth sometimes of several feet. Fire once kindled in this is very tenacious, smouldering beneath the surface often for weeks, surviving even heavy showers, and when favored by dry weather and shoreward breezes, spreading into the forest and shooting up the inflammable spruces and balsams—the adjacent hardwood trees remaining meanwhile uninjured. To meet such cases it is necessary that all brush should be piled at least two rods from the standing timber and the intervening space cleared of duff and vegetable mould by means of grub hoes. Plowing, as called for by the specifications, or other common methods of forest fire prevention, were in many places inapplicable

because of the presence of extensive areas of boulders and rough ground. Generally, fire kindled near the new flow line would not run down the slope, but by first burning the brush adjacent to the standing timber, fires could afterward be started with safety near the water's edge, and it would then burn over the intermediate space, readily running up the slope.

At points along the margin, where hardwood timber chiefly prevailed, the danger from spreading fire was comparatively slight, although in order that the brush might be burned clean at the first firing, and not require additional labor of picking up and reburning, it was necessary that the brush be dry and closely compacted in the piles.

A third portion of the flowage consisted of flat lands in the valleys, or bays, at the mouths of tributary streams. Chief among these we may mention Jessups River, the valley of which will be flooded, forming a lake, and having an average width of slightly over one-eighth of a mile. This area was covered with trees, chiefly beech, black birch, swamp maple and water elm. Inasmuch as this area is flat, and lies in a deep valley, unaffected by winds, burning by back-firing was successfully resorted to.

As to the disposition of the force employed on the clearing, it may be stated that this work was carried on by gangs of men of about twenty each, under one foreman. Laborers receive $1 per day and their board, and foreman $35 per month and board. The average cost per acre of cutting, including some piling, but not the burning, was $7.50, and the rate of cutting averaged one-fifth acre per man per day.

THE CONSTRUCTION OF THE DAM.*

The new dam is located about 150 feet below the old wooden dam, the site being selected not only on account of the availability of the old dam as a coffer dam during the construction of the new dam, but further because the most economical profile was found at that point. Granitic rock, underlying several feet of boulders in the bed of the river and extending up the west bank within a few feet of the surface, forms the foundations of the main wall and gate house. An independent spillway is obtained by excavating the solid rock of the hill on the west side. The east bank is composed of an impervious sand hardpan, a formation which is quite common in the glacial drift deposits of the Adirondacks. At the east end of the dam the bed-rock in the river was found to extend for a considerable distance almost horizontally under the bank of glacial drift or hardpan, thus determining an earthen embankment with core wall as the natural form of construction on that side. The main dam wall, the wing wall, and the core wall are all joined together, as shown on the plans, the core wall being carried well back on the rock into the impervious drift.

* The account of the construction of the Indian River dam was prepared by Wallace Greenalch, who was Assistant Engineer on the work.

PROFILE OF DAM.

The section of the main wall of the dam at its greatest height is forty-seven feet high, seven feet wide on top and thirty-three feet on the bottom; the width being gradually increased by batters on both faces. The top of the coping is seven feet above the level of the spillway and the top of the embankment is two feet higher.

GATE HOUSE AND DISCHARGE TUNNELS.

To provide for the passage of water through the dam during construction, two discharge tunnels, nine feet in diameter, are built through the main wall at the west side of the river channel. The arch and invert rings are of selected rubble work, twenty inches deep. Three buttresses, one on each side and one between the openings, compensate for the masonry taken from the section of the main wall by the discharge tunnels. The gate house is situated on the upper side of the dam, opposite the discharge tunnels, and consists of two wells eight feet square at the bottom and 12 x 14 feet at the top, with side walls eight feet thick at the bottom, battering to four feet at the top. The object of the two discharge tunnels was to take care of any large floods which might occur while the lower part of the dam was under construction, and thus prevent the water from flowing over newly laid masonry. For the permanent discharge from the reservoir, steel pipes, five feet in diameter and ten feet long, were built in masonry inside the nine-foot discharge tunnels. It was the original intention not to lay them in place until the main dam wall had been carried to a height above all danger from possible floods. The contractors, however, wished to lay the pipes as soon as the inverts of the tunnels were finished, and upon their agreeing to make good all damages which might be received from floods, they were allowed to do so. Fortunately no large floods occurred during the construction of the dam and the leakage and overflow from the old wooden dam was easily carried by the two five-foot openings. Single-disk flume gates made by Eddy Valve Co. are bolted to the pipes by flanged connections and regulate the discharge from the reservoir. Each gate-well is provided with two 3 x 5-foot sluice openings, controlled by wooden slide gates and protected by steel gratings. Owing to the difficulty of operating the slide gates on account of the excessive friction under full head of water, provision is made for filling the gate-wells by means of six-inch pipes built through the walls of each well. A suitable superstructure with masonry side walls and shingle roof encloses the operating mechanisms of all the gates, as well as the apparatus for indicating the opening of the main gates. The maximum discharge through the two discharge pipes with full reservoir is estimated at 1,400 cubic feet per second, although it is not expected to discharge at a greater rate than about 1,000 cubic feet per second.

SLUICE WAY FOR LOGS.

LOGWAYS.

Inasmuch as there is a large amount of valuable spruce timber still standing in the forests adjacent to Indian Lake and its tributaries, it became necessary to provide a logway for floating out the logs each spring. The main logway is fifteen feet in width, with the bottom ten feet below the spillway level, and is situated just west of the gate house. Heavy buttresses on each side carry the pressure of the water against the logway when closed, as well as form a gangway for the logs after passing the opening. The logway is controlled by means of forty-five 4 x 8-inch spruce timbers or "needles" about twenty feet long, placed edgewise to the water in the reservoir. The needles are operated by a block and fall suspended from a gallows-frame above the needle-frame. For the purpose of floating out old snags or logs when the water is at or above the level of the spillway, a subsidiary logway, with the bottom eighteen inches below the spillway level and controlled by three 6 x 12-inch timbers, has been provided at the east end of the spillway.

SPILLWAY.

The spillway is located at the west end of the dam and is spanned by a foot bridge resting on five masonry piers. The effective spill is 106½ feet long, and with the water up to the bottom of the floor stringers, about six feet in depth would allow a discharge of 5,000 cubic feet per second. With the large temporary storage of the reservoir it is not considered, however, that a discharge approximating 5,000 cubic feet per second will ever take place. The spillway is seven feet wide in section with a downward slope of eighteen inches toward the back or upstream face. The top is coped with large selected stones firmly doweled to the masonry.

EMBANKMENT.

The embankment at the east end of the dam is fifteen feet wide on top, with a rip-rapped slope of two and one-half to one on the upper or water slope and two to one on the lower slope. A rubble masonry core wall extends through the center of the embankment and into the hardpan from eight to twenty feet. The trench for the core wall was made four feet wide, with vertical sides, and then filled solid with rubble masonry. From the surface of the ground the wall batters to two feet wide at the top. The embankment was deposited in twelve-inch layers, sprinkled, and thoroughly rolled with a two-ton roller. As no clay was to be found in the vicinity, some of the hardpan was deposited next to the core wall on the water side and thoroughly compacted by cutting and cross-cutting with spades. The object of

this puddling was merely to insure an extra precaution against leakage from possible cracking of the core wall, as well as to prevent water from following along the surface of the masonry. Special care was taken in laying both the core wall and embankment to have them watertight. On the lower side of the dam, at the junction with the main wall, the embankment is held in place by a wing wall, but on the upper side the embankment is allowed to assume the two and one-half to one slope until it rests against the main dam wall.

MORTAR AND CONCRETE.

The cement used in the work was delivered in barrels at North Creek by railroad and from thence hauled by wagon about twenty-two miles over a mountain road. The sand used was obtained from a bank on the shore of the lake about two miles from the dam and was transported to the work in a scow having a capacity of thirty cubic yards per load. The scow was propelled by means of an anchor with a long rope and a windlass, after the ordinary method of moving lumbermen's rafts on lakes. Advantage was also taken of favorable winds by hoisting a large sail. In this manner a crew of six men and a foreman were able to deliver about 720 cubic yards of sand and 180 cords of wood, for the steam boilers, per month, the wood being taken from points along the lake, in some cases several miles from the work. The sand obtained was of excellent quality, being almost entirely free from loam and exceedingly sharp. The mortar was composed of three and one-quarter parts of sand to one part of cement by volume, except for pointing and for bedding the lowest course of masonry, where two to one mortar was used. The sand and cement were thoroughly mixed dry on a platform by means of hoes until the mixture acquired a uniform color. It was then mixed wet by passing through a mechanical mixer of the paddle type.

The proportions for making concrete were experimentally determined by measuring the voids in the broken stone to be used, and allowing a little more mortar than necessary to fill the voids. The proportions by volume of the dry materials were one part of cement, three and one-quarter parts of sand and seven and one-half parts of broken stone. This was found to yield an excellent concrete. In making the concrete, the sand and cement were first mixed dry as for mortar and then spread in a layer over the broken stone. The whole was then shoveled into the mixer, where the water was supplied through jets, and all thoroughly mixed by the paddles in going through the mixer. The concrete dropped from the mixer directly into wheelbarrows or derrick boxes and thence was taken to the work.

FOUNDATION AND MASONRY.

The surface rock in the river bed and on the west bank was quite seamy and disintegrated and was, therefore, removed by blasting until solid rock was reached. This was usually at a depth from three to six feet below the surface. The rock thus found was remarkably free from any but fine closed seams and made an ideal foundation for the dam. A few small springs were found under the main wall, but were easily taken care of by building masonry wells around them in the following manner: About a foot or two in height was built at a time, so that as the well filled with water the pressure would not be sufficient to wash out the freshly laid mortar from the walls of the well. Successive courses of masonry were built up as the preceding courses became set, until the water from the spring had reached the level at which it would flow no more. The water was then bailed out and the well filled with rich concrete. The height to which the wells had to be built did not exceed four or five feet. Before laying any masonry great care was taken to remove all the rock which had been loosened by blasting and then to thoroughly clean the freshly exposed surface with a hose and brooms. The surface left by the removal of the loose rock was quite irregular, but to further insure against water following the foundation a layer of three or four inches of two to one mortar was spread over the foundation, and the first course of masonry bedded in it. The rock excavated from the bywash channel and from the foundation, while solid, was found to break quite irregularly and could not therefore be used for the facing of the dam, though entirely suitable for backing. The facing was composed of large sized stone obtained from two quarries which were opened up within about 500 feet of the east end of the dam. The stone—a syenitic granite—is of a pink color, fine grained and extremely durable, as was shown by the weathered outcrops of the quarry. It was found to be easily quarried into blocks, ready, with little or no work on them, to be laid into the dam. Considerable latitude was allowed in the joints of the facing, from one and one-quarter to one and one-half inch joints being about the average obtained. The backing consisted of large irregular stones laid in full mortar beds about a foot apart, with the intermediate spaces filled with concrete thoroughly rammed to place. Stones of different sizes were purposely laid adjacent to each other, so as to avoid any regular coursing of the backing. The use of concrete in the above manner had the effect of considerably reducing the quantity of cement which would be required had the masonry been laid up in the ordinary manner by masons. No account was kept of the amount of cement used in pointing with two to one mortar, but an average of the whole work gives about twenty-seven per cent. mortar.

COST OF WORK.

The average cost per cubic yard of masonry laid during July and August, when the work was well under way and the conditions favorable, is as follows:

Quarrying face stone, average for month's work,	$0.35
Labor of laying masonry,	.53
Labor of pointing,	.15
Mixing mortar and concrete and crushing stone,	.20
Cost of cement,	2.00
Cost of sand,	.15
General expenses, superintendence, etc.,	.27
Total,	$3.65

It was found impossible to reach anything like these figures except under the most favorable conditions.

The stone used for backing was paid for as excavation of rock, the cost of the labor of excavating the same during July and August amounting to forty-six cents per cubic yard.

The main wall is coped with concrete twelve inches in thickness, laid in place on the dam in sections about ten feet long. Each section was allowed to set before the next was laid, thus making a transverse joint to allow for expansion and contraction.

The dam was constructed in about seven months, the work beginning in April and ending in October, 1898. With the exception of the cement, iron work and contractors' supplies, which were transported by wagon from North Creek, this work was remarkable for the favorable conditions obtaining. Facing, backing, riprap, broken stone for concrete and lining, and earth for the embankment were all obtained immediately at the dam site. Sand and wood for fuel were delivered by boat directly at the work, both being obtained on the shore of the lake a few miles away. The timber and lumber, except the oak, which came by rail, were obtained at sawmills within three miles of the work. The use of the old dam as a coffer dam made "bailing and draining" a comparatively small item of expense.

In connection with the foregoing it may be noted that similar conditions are found at many of the dam sites examined and projected for water storage on upper Hudson. Suitable materials for the construction of masonry dams are found at most of the sites, and it is one of the marked coincidences that at many of the sites a hardpan bank occurs on one side of the river valley resting on granite rock, which forms the bed of the river and extends up the other side.

In view of the peculiar circumstances of the letting, it was deemed desirable to keep much more careful force accounts than are ordinarily kept on such work, the

said amounts including, so far as possible, expenses of every sort and kind. The following statement of the actual cost of the work has been compiled from force accounts so kept and from information furnished by the contractors:

Labor, not including clearing margins,	$31,218
General expense,	9,601
Raw material,	18,830
Interest,	1,150
Payments made or to be made, account clearing,	13,000
Team work, delivery of cement and supplies,	6,836
Insurance,	1,235
Freight,	960
Barn account, teams owned by contractor,	725
Total amount,	$83,555

WHY FORESTS CONSERVE STREAM FLOW.*

We now approach the third division of our subject—the data of stream flow in relation to forests. As stated at the beginning of the paper this subject has been as yet only casually considered in the United States, although abroad the general question of forest influences has been extensively considered, not only as regards run-off of streams, but in its relations to many other questions as, for instance, the relation of the temperature under woods and outside; the determination of rainfall under woods and outside; the influence of the forest floor covering on the humidity of the soil and on evaporation from the same; the amount of evaporation in the forest and without; the quantity of ground water at different depths under woods and outside, with various aspects and under various kinds of trees; the hygrometric condition of the air under woods and outside; the rain and snow reaching the ground under woods and outside; and many other questions have been studied. In the United States, thus far, the foregoing divisions of the subject have, with one or two exceptions, been left untouched, although measurements of stream flow have, during the last few years, been carried on in many places.

Moreover, the subject has, for the reasons already assigned, attracted considerable attention, and been, in consequence, the object of a great deal of popular writing, in which the most diverse views have been expressed. It has been held that forests not only increase rainfall, but that they increase the total annual flow of streams, at the same time retarding the rate of surface run-off, thereby decreasing the severity of

* A portion of the following chapters is from a lecture on The Data of Stream Flow in Relation to Forests, before the engineering classes of Cornell University, April 14, 1899.

floods. The contrary view, that forests not only do not increase precipitation, but that they are without effect on rate of run-off, and hence that floods are quite as great from forested as from deforested areas, has been strongly championed.

The author has no desire to question the good intentions of the gentlemen presenting the views referred to. He recognizes that the chief difficulty with some of the recent writers on this subject—especially the authors of popular articles in the magazines—has been an evident lack of full acquaintance with the physical data really applying. One object of the present discussion is to some extent supply this lack by actually quoting these data, or, when too extended for citation, to indicate where some of the more important may be found.

The author does, however, wish to point out as a tentative proposition, that the real reason why forested areas furnish more water in the streams for a given rainfall than do deforested and cultivated areas, is because forests, on the whole, consume less water than do deforested and cultivated areas. The data herein given are especially directed toward establishing this tentative proposition.

DIVISIONS OF THE SUBJECT.

We may discuss the subject under the main divisions, Rainfall, Temperature, Hygrometry, Evaporation and Forest Data and the Relation Between Rainfall and Run-off. This division is necessarily taken somewhat arbitrarily, one frequently running into another, and is made merely for the purpose of assisting somewhat in handling the data.

Before proceeding to the main discussion, the author may very properly indicate that while, as a tentative proposition, he has no doubt that, other conditions remaining the same, forest areas yield more water from a given rainfall than do similar deforested areas—and certain data derived from recent studies in the State of New York will be presented strongly substantiating this view—nevertheless, it is recognized that some of the information really needed for final conclusions, is not yet gathered, and in consequence all final conclusions are necessarily delayed for many years—at any rate so far as the comparison of broad areas widely separated is concerned. Illustrations of why this is true will be given further on.

The foregoing definition of what seems to the author to be the present state of the data of the stream flow in relation to forests, is made necessary because one of the mooted questions at the present time is as to the proper method of investigation to be pursued. The foreign studies of forest meteorology have been mostly carried on with reference to comparing temperature, hygrometric and other meteorological conditions in the forest, with outside conditions, the run-off of streams having been, generally speaking, only casually considered.

The author's present view is that final results will not be obtained until studies extending over a considerable number of years have been made, not only of the run-off of the streams from similarly situated contiguous areas, the one forested and the other deforested, but of the meteorological conditions of such areas, including temperature, dew point, humidity, vapor pressure, precipitation, and wind velocity. By way of illustrating how these several elements vary in different parts of the United States, the following tabulation has been compiled from the Annual Reports of the Chief of the United States Weather Bureau for the years 1891–96, inclusive, the places therein given, at which complete observations have been kept, being selected with reference to showing what considerable variations in these elements prevail in different parts of the United States. It may be noted in passing that temperature, dew point, humidity, vapor pressure, precipitation, and velocity of wind, are the elements determining the intensity of evaporation.

TABLE SHOWING MEAN VARIATION OF YEARS 1891 TO 1896, INCLUSIVE, IN METEOROLOGICAL CONDITIONS IN DIFFERENT PARTS OF THE UNITED STATES.

NAME OF PLACE	MEAN TEMPERATURE	DEW POINT		RELATIVE HUMIDITY		VAPOR PRESSURE		PRECIPITATION	WIND—AVERAGE HOURLY VELOCITY
		8 A. M.	8 P. M.	8 A. M.	8 P. M.	8 A. M.	8 P. M.		
	F°	F°	F°	Per ct.	Per ct.	Inches	Inches	Inches	Miles
Abilene, Texas, . .	63.8	47.3	45.3	76.3	48.0	.374	.340	23.79	11.0
Albany, N. Y., . .	48.5	39.2	40.8	80.3	73.5	.292	.303	34.12	7.7
Block Island, R. I., .	49.0	42.7	44.0	81.0	82.3	.320	.332	43.03	16.4
Boston, Mass., . .	49.5	39.1	40.8	73.3	72.7	.282	.299	39.32	12.3
Buffalo, N. Y., . .	47.0	38.1	38.7	74.7	70.5	.270	.276	37.25	11.9
Cleveland, Ohio, . .	49.4	39.6	41.3	77.0	71.0	.290	.305	32.64	12.1
Denver, Col., . .	49.8	25.7	26.2	57.3	38.0	.150	.159	14.66	7.7
El Paso, Tex., . .	63.4	30.8	24.7	49.3	23.8	.206	.166	7.11	9.7
Los Angeles, Cal., .	61.9	46.0	50.8	80.0	64.5	.331	.383	14.23	3.6
Oswego, N. Y., . .	45.8	37.2	38.0	77.2	72.8	.266	.268	34.71	11.2

RAINFALL.

Meteorology may be defined as, broadly, the study of the atmosphere, its properties, motions and appearances, etc., an orderly arrangement of all the facts relating thereto constituting the science of meteorology.* The consideration of

* See Meteorology. By Thomas Russell, U. S. Engineer. Also, Meteorology; Practical and Applied. By J. William Moore.

rainfall in relation to the run-off of streams may be considered a division of applied meteorology.

ANNUAL RAINFALL.

In compiling rainfall records for purposes of comparison with run-offs of streams, it is the author's custom to arrange them in a water year beginning with the month of December, and ending with November. Such a year is again divided into three periods, December to May, inclusive, constituting the storage period; June to August, inclusive, the growing period; and September to November, inclusive, the replenishing period. During the storage period a large per cent. of the total rainfall appears as run-off in the streams, while in the growing period the percentage of rainfall appearing in the streams is very small, the bulk of the precipitation of that period being used up by plant life and evaporation from the surface of the ground. Usually the stored ground water is so drawn upon during this period as to produce a low water table. The replenishing period is an intermediate stage during which evaporation gradually decreases, and provided the rainfall is not deficient, ground water rises to its usual height. Naturally these periods run more or less into one another, depending upon whether seasons are advanced or retarded.*

The English writers on hydrology make a water year beginning with September and ending with August. This water year is again divided into a winter period extending from October to March, inclusive, and a summer period from April to September, inclusive, as best fitting the conditions of English climate. Mr. Beardmore, in his Manual of Hydrology, proposes a water year of three periods of four months each, the first including November to February, inclusive, which he calls the winter division; the second, March to June, inclusive, the spring division; and July to October, inclusive, the summer division. This plan, Mr. Beardmore considers, gives better opportunity for comparison. As regards American climatic conditions, however, the author considers the division into storage, growing and replenishing periods, as given in the foregoing, on the whole, the best arrangement.†

* For examples of rainfall and stream run-off records written up with reference to a water year extending from December to November, inclusive, and divided into storage, growing and replenishing periods, see the author's several reports on Genesee and Hudson Rivers Storage Projects, in the Annual Reports of the State Engineer and Surveyor, for 1895–96, inclusive.

† See (1) Beardmore's Manual of Hydrology, pp. 2–81; (2) Harrison's paper On the Subterranean Water in the Chalk Formation of the Upper Thames, and its Relation to the Supply of London, in the Proc. Inst. C. E., Vol. CV (1891), pp. 35–46; (3) Evans' paper On the Percolation of the Rainfall on Absorbent Soils, in Proc. Inst. C. E., Vol. XLV (1876), pp. 208–216; and (4) Graves' paper On Evaporation and Percolation, also in Proc. Inst. C. E., Vol. XLV (1876).

RAINFALL DATA IN THE UNITED STATES.

The chief sources of information as to rainfall in the United States are (1) the Annual Report of the United States Weather Bureau; (2) the monthly and annual publications of the various State Weather Bureaus; and (3) a large amount of manuscript records collected by the Smithsonian Institution previous to the establishment of the United States Weather Bureau in 1871, and now in possession of the Chief of the Weather Bureau, and to be had by investigators on correspondence with his office. In addition to the stations of the United States Weather Bureau located at many of the important cities of the country, all of the States and Territories maintain Weather Bureaus and publish the results either in monthly or annual bulletins. The State records are also tabulated in the Annual Report of the United States Weather Bureau. The Annual Report of the Chief of the Weather Bureau has, however, only been published in its present complete form since the year 1891, and it has the disadvantage to the student who desires up-to-date data, of being about two years behind in publication. If, therefore, one desires the recent data, they may be obtained from the Bulletins of the State and Territorial Bureaus, or by correspondence with the Chief of the United States Weather Bureau.

TEMPERATURE.

The foregoing statements as to sources of information about precipitation may be also taken as applying to temperature, hygrometry, etc., except that, generally speaking, the State and Territorial weather services have not gone extensively into hygrometric observations, the most of this work being confined to the stations of the United States Weather Bureau.

MEAN ANNUAL AND MONTHLY TEMPERATURES.

A study of the table showing variation in meteorological conditions in different parts of the United States on page 409, leads to the tentative conclusion, that evaporation from the surface of the ground varies broadly. Thus, at Abilene, Texas, the mean temperature for the period considered in the table is 63.8°, while at El Paso, Texas, 450 miles west, the mean temperature is shown to be 63.4°. The mean dew point at Abilene is 47.3°, at 8 a. m., and 45.3° at 8 p. m.; while at El Paso it is 30.8° at 8 a. m., and 24.7° at 8 p. m. At Abilene the relative humidities, as per table, are 76.3 and 48.0 per cent.; while at El Paso they are 49.3 and 23.8 per cent. Vapor pressures at Abilene are 0.374 and 0.340; and at El Paso, 0.206 and 0.166; the mean rainfall at Abilene, 23.79 inches, and 7.11 inches at El Paso. The average hourly velocity of the wind at Abilene is 11.0 miles, and at El Paso, 9.7 miles. The country

about both places is an elevated, dry region, entirely destitute of any water on the surface, and with very little timber, except small fringes along the margins of streams. It is perfectly clear to the author, from former experience in central and west Texas, that while the mean temperature at these two places are substantially the same, the natural evaporation, except accidentally, is much greater at El Paso than at Abilene, although it may be pointed out that since wind movement is one of the controlling factors in evaporation, the lower average velocity of wind at El Paso will tend to reduce the average evaporation there. The difference in rainfall at the two places must also be taken into account in considering actual evaporation results. The broad proposition is that with equal rainfalls at the two places, other conditions remaining as shown by the tabulation, the evaporation either from water or from land surfaces will probably be greater at El Paso than at Abilene, although, possibly, the difference in wind velocity might accidentally make the two not very different. Similar comparisons can be made for other stations, as, for instance, between Block Island and Boston, where the mean temperatures are nearly the same, but where there are large variations in the other elements controlling evaporation. A coincidence in evaporation depths at these two places would merely mean an accidental balancing of all the forces influencing evaporation. We need, therefore, not only tabulations of mean monthly and yearly temperature as a necessary part of the study on this line, but tabulations of all the other elements influencing evaporation before we can decide.

CONSTANCY OF TEMPERATURE.

Temperature is a tolerably constant meteorological element, as may be inferred from the following statistics of mean annual temperatures.*

At St. Petersburg there is a record of temperature since 1743, the mean of which to 1875, inclusive, is 38.6°, the highest annual temperature being 42.4° in 1822, and the lowest 34.1° in 1815. At Paris, records kept from 1735–1890, inclusive, show a mean temperature for the whole period of 51.4°, the highest annual temperature of 57.6° occurring in 1781.

The following are the annual temperatures at Philadelphia for various groups of years from 1758–1889, inclusive:

1758 to 1777,	52.6°
1798 to 1804,	54.2°
1829 to 1838,	51.5°
1825 to 1845,	53.1°
1846 to 1867,	54.0°
1871 to 1889,	53.1°

* For these long temperature records, see Russell's Meteorology, pp. 103, 104.

The lowest annual temperature at Philadelphia, 48.2°, was in 1836.

A study of temperature records, so far as the author has carried such a study, seems to show that there is no direct relation between the run-off of streams and mean annual temperature, although on this point he does not wish to be understood as yet passing a final judgment.*

HYGROMETRY.

Hygrometry may be defined as that branch of meteorology which is concerned with the determination of the amount of water present in the air in the form of vapor. The degree of humidity is its hygrometric state. When expressed as a per cent., it is relative humidity, but when the tension or elastic force of aqueous vapor which represents the pressure of all the vapor in the air above the point of observation is expressed in terms of inches of a mercury column, it represents the absolute humidity of the air.†

VARIATIONS IN THE HYGROMETRIC STATE.

The hygrometric state varies greatly at different times of day and different seasons. For diagrams and tables illustrating these variations, see Durand-Claye's *Hydraulique Agricole et Genie Rural*, Chapter 7.

EVAPORATION.

GENERAL FORMULA FOR EVAPORATION.

So far as the English literature of the subject is concerned, the most satisfactory discussion of evaporation is that of Mr. Fitz Gerald,‡ whose formula for evaporation is as follows:

$$E = \frac{\left(V - v\right)\left(1 + \frac{W}{2}\right)}{60}$$

In this formula, V means the maximum force of vapor in inches of mercury corresponding to the temperature of the water; v, the force of vapor present in the

* For a large number of temperature records in the State of New York, tabulated with reference to a water year from December to November, inclusive, and divided into storage, growing and replenishing periods, the same as for rainfall records, see the author's Reports on the Genesee and Hudson Rivers Storage Surveys, in the Annual Reports of the State Engineer and Surveyor, as previously cited.

† Refer to Moore's Meteorology, Chapters XVI to XX.

‡ See paper on Evaporation. By Desmond Fitz Gerald. Trans. Am. Soc. C. E., Vol. XV (Sept. 1886), pp. 581-646.

air; W, the velocity of the wind in miles per hour, and E, the evaporation in inches of depth per hour. It can be shown that there is going on nearly always a condensation of moisture from the air, upon any water surface. At the same time there is going on a loss of moisture from the water to the air. The intensity of both these operations depends upon the difference in temperature between air and water. When the temperatures of air and water in contact are the same, both processes stop. Evaporation is, therefore, the measure of the difference of these two exchanges. The experiments of Mr. Fitz Gerald and others have shown that evaporation from water surfaces is subject to a definite law, expressed by the formula just given, but evaporation from the ground has never been reduced to any such simple expression. Various difficulties arise which apparently render it impossible to make a single expression covering all the phenomena involved. If the surface of the ground be kept constantly wet, evaporation therefrom goes on substantially as from water surfaces. The main difficulty, therefore, in reducing evaporation from the ground to a simple formula, is largely due to uncertainty of the water supply. The demands of evaporation from the surface of the ground are continuous, the same as from other surfaces, but constant interruptions by either complete or partial exhaustion of the available supply, complicate the action so much as to render expression by formula apparently impossible. Varying demands of vegetation at different seasons also further complicate the problem.

EVAPORATION DATA.

Evaporation data applying to water surfaces at Boston may be found in Mr. Fitz Gerald's paper already referred to. For evaporation from the land surfaces of several catchment areas in the United States, refer to the author's paper On the Water Resources of the State of New York, No. 24 of the Water Supply and Irrigation papers of the United States Geological Survey; and for evaporation data at Rochester, refer to the Annual Reports of the Executive Board of the City of Rochester, 1891–98, inclusive; also to the author's Report on the Genesee River Storage Surveys, and to the paper on the Water Resources of the State of New York.

For evaporation data abroad, at a number of foreign points, refer to Beardmore's Manual of Hydrology and to Durand-Claye's *Hydraulique Agricole et Genie Rural*, page 257, where evaporation data applying to Paris, Turin and Lake Fucino, may be found. Tables showing the hourly variation of evaporation may be found in Mr. Fitz Gerald's paper, and in Durand-Claye's. A number of tables of evaporation at foreign points are given in the author's Report on the Upper Hudson Storage Surveys for 1896.

CONDITION CHIEFLY AFFECTING EVAPORATION.

The evaporation from a water surface depends upon several elements outside of temperature, as, for instance, the hygrometric state exercises a certain action, but the agitation and constant change caused by wind movement exercises the greatest influence of all, because of quickly removing layers of air in contact with the liquid surface, substituting others in place of them.*

DOUBLE SIGNIFICANCE OF THE TERM EVAPORATION.

Mr. Beardmore points out in his Manual of Hydrology that the term evaporation is, in reality, of double significance, the engineer regarding it as much with reference to the quantity lost when the soil is wetted by rain or dew, as the amount merely evaporated from exposed surfaces of water, which is the evaporation of the meteorologist. Writers on general meteorology have thus far only casually taken into account land evaporation.

NEGATIVE EVAPORATION.

This term may be taken to mean that when the temperature of the dew point is higher than that of the evaporating surface, water is deposited on that surface. Studies of run-off data in comparison with rainfall and without regard to forest meteorology indicate that on some watersheds this is, perhaps, a frequent condition. We need forest meteorology, therefore, to correct the uncertainty of run-off observations in this particular.

EVAPORATION FROM NAKED SOIL.

As already pointed out, evaporation from the ground follows substantially the same law as evaporation from water surfaces, varying in accordance with temperature, hygrometric state, wind movement, etc., and further varying with the nature of the soil. Experiments on this line were made by Maurice at Geneva, Switzerland, in 1796, and by De Gasparin, at Orange, France, in 1821, from which were determined the ratios between evaporation from the soil and rainfall for those years, as 0.61 for the first, and 0.88 for the second. More recent studies show that these old determinations have historical value only. Very recent French experiments are those of Marie-Davy, made at the Municipal Observatory of Montsouris, as recorded in the Annual Report of the Montsouris Observatory. Probably the best experiments are those made in England, where the percolation through drain gages has been observed at the

* Also refer to Fitz Gerald's paper, Beardmore's Hydrology, etc., for more extended statements as to conditions affecting evaporation.

Rothamsted Agricultural Experiment Station and at other places for a number of years.* We may cite some of the results obtained by Mr. Graves, and detailed in his paper On Evaporation and on Percolation before the Institution of Civil Engineers, Volume XLV. The following summary of results for fourteen years, all in inches, includes the rainfall and percolation through turfed soil and through a bed of deep, fine sand, the soil and sand being contained in a strong, open topped, water-tight, slate box or tank, with an area of one square yard and thirty-six inches in depth. The soil is turfed over and the grass occasionally cut.

YEAR	RAINFALL	PERCOLATION		EVAPORATION		
		GROUND	SAND	GROUND	SAND	WATER
1860,	32.56	10.76	24.36	21.80	9.10	21.06
1861,	23.63	5.71	16.36	17.92	7.27	25.01
1862,	26.58	8.55	21.18	18.c3	5.40	17.33
1863,	19.77	3.76	16.41	16.01	3.36	18.27
1864,	15.89	3.82	12.64	12.07	3.25	18.64
1865,	29.25	11.15	27.82	18.10	1.43	20.12
1866,	31.70	12.59	28.11	19.11	3.59	18.82
1867,	27.44	5.16	22.42	22.28	5.02	20.06
1868,	23.31	7.11	20.20	16.20	3.11	26.93
1869,	24.56	8.05	22.14	16.51	2.42	19.06
1870,	20.40	7.23	18.70	13.17	1.70	20.40
1871,	24.08	6.19	20.08	17.89	4.00	19.58
1872,	37.17	12.03	30.05	25.14	7.12	22.92
1873,	23.77	4.05	20.12	19.72	3.65	20.40
Mean,	25.72	7.58	21.41	18.14	4.31	20.61

EXPERIMENTS AT GENEVA.

Experiments at the New York State Agricultural Experiment Station at Geneva may also be referred to. In August, 1882, the Geneva Agricultural Experiment Station began a set of observations on the amount of percolation through three drain gages, gage No. 1 being covered with sod, with the grass kept short by frequent cuttings; gage No. 2 was kept free from all vegetation, its surface being left undisturbed, while the surface of No. 3 was kept in a loose and fine condition by frequent stirrings with a trowel. These experiments were continued from 1882 until 1890.†

* Extended references to these data may be found in the author's Report on the Upper Hudson Storage Surveys for 1896.

† For full detail see the Annual Reports of the New York Agricultural Experiment Station at Geneva from the Second (1883) to the Ninth (1890).

The following table gives the average rainfall and percolation through each of the three gages for the period from August 1, 1882, to November 1, 1887, inclusive:

MONTH	RAINFALL Inches	DRAINAGE SOD Inches	DRAINAGE BARE SOIL Inches	DRAINAGE CULTIVATED SOIL Inches	DRAINAGE AVERAGE Inches
January,	0.939	0.289	0.374	0.351	0.338
February,	1.596	1.021	0.831	0.610	0.821
March,	1.030	0.669	0.687	0.636	0.664
April,	1,834	0.655	0.968	0.964	0.862
May,	2.180	0.248	0.598	0.929	0.592
June,	2.710	0.244	0.287	0.738	0.423
July,	4.146	0.001	0.742	0.868	0.537
August,	3.032	0.002	0.629	0.878	0.503
September,	1.952	0.027	0.493	0.762	0.427
October,	1.733	0.016	0.537	0.611	0.388
November,	1.722	0.192	0.360	0.846	0.466
December,	0.850	0.098	0.442	0.372	0.304
	23.724	3.462	6.948	8.565	6.325

A new set of drain gages, provided with an artificial water table, were set up at Geneva in 1888, but thus far the results gained with them have not been discussed at length in the Annual Reports. As to whether or not the Geneva gages are still in service is unknown, although the author cannot but think that some agricultural station, at any rate, should carry out to final conclusions such a set of experiments as was begun at Geneva.

RISLER'S PAPER ON EVAPORATION FROM THE SOIL.

Probably the most satisfactory data as to evaporation from soil are contained in a paper, *Sur l'Evaporation du Sol*, by E. Risler, published in the *Bibliotheque Universelle et Revue Suisse, Archives des Sciences Physiques et Naturelles*, for September, 1869. In this paper Risler gives the detail of experiments carried out by him on his estate at Caleves, near Nyon, Switzerland. The following matter is translated from the paper:

"Meteorologists have made many attempts to procure the proportion of the rainfall which is returned to the atmosphere by evaporation either directly by evaporation from the ground, or by passing through vegetation. To determine these facts, different methods have been used.

"The method which I have employed for solving the problem, differs completely from those used by other experiments. Thus, my method consists in gaging the amount of water issuing from under-drains, draining a certain known area, and in comparing the amount of drainage water with the amount of rainfall on the same surface, the difference between the two giving the quantity of water evaporated.

"In order to successfully apply this method, two principal conditions must be observed:

"(1) No other water should be allowed to come in contact with the earth except the rainfall directly upon the surface. For my experiments, a piece of land 12,300 square meters, situated upon the highest part of a clay plateau, was selected. No water could reach this area from the neighboring soil.

"(2) It is necessary that all the water which is not evaporated be received by the drains, this second condition being equally important with the first. In the area experimented upon, the sub-soil is so compact that the drains, which are laid at a depth of forty-seven inches and thirty-three feet apart, must necessarily receive all the water which penetrates beneath the surface, and which is not evaporated.

"The experimental field fulfills all the necessary conditions. It has no trees. In 1867 two-fifths of the area was planted to potatoes, two-fifths to wheat, three-twentieths to Lucerne-grass, and one-twentieth in ditches carrying the drainage water. In 1868, two-fifths were in wheat, two-fifths in clover, three-twentieths in Lucerne-grass and one-twentieth in ditches. Gagings of the drainage water were made at noon each day at a point below where all the drains come together.

"The following table gives the quantity of rainfall for each month of the years 1867, 1868, the run-off of the drains and the quantity of water evaporated. These figures show that in 1867 the evaporation was 68.75 per cent., and in 1868 73.17 per cent. of the rainfall, or making certain corrections because of the water in the soil, we have the final figures for 1867, 70.75 per cent., and for 1868, 70.17 per cent."

RISLER'S EXPERIMENTS ON THE YIELD OF WATER FROM UNDERDRAINED AREAS.

MONTH	1867			1868		
	RAINFALL IN INCHES	RUN-OFF BY THE DRAINS	EVAPORATION	RAINFALL IN INCHES	RUN-OFF BY THE DRAINS	EVAPORATION
January, . .	5.413	4.048	1.365	2.391	0 896	1.494
February, . .	2.486	1.679	0.807	0.374	0.337	0.037
March, . .	8.139	3.716	4.423	3.697	1.920	1.776
April, . . .	6.172	2.804	3.367	2.598	0.159	2.439
May, . . .	3.972	0.709	3.263	1.649	0.045	1.604
June, . . .	3.179	0.028	3.151	1.862	0.000	1.862
July, . . .	1.238	0.000	1.238	4.704	0.000	4.705
August, . .	1.958	0.000	1.958	2.906	0.000	2.906
September, . .	3.904	0.000	3.903	6.216	0.081	6.135
October, . .	3.693	0.130	3.562	4.194	0.958	3.236
November, . .	0.293	0.000	0.293	1.978	0.784	1.229
December, . .	1.545	0.000	1.545	8.051	5.727	2.324
Total for year,	41.992	13.114	28.875	40.620	10.907	29.747

As shown by the table, the evaporation loss in 1867 was 28.87 inches, and in 1868, 29.75 inches. These figures are especially interesting as representing the total evaporation loss from a catchment basin with an annual rainfall of from forty to forty-two inches. They may be instructively compared with the evaporation data of Genesee River given further on.

COMBINED EVAPORATION OF SOIL AND GROWING PLANTS.

The foregoing extracts from Risler's paper, *Sur l'Evaporation du Sol,* and the accompanying table, serve to illustrate the combined evaporative effect of the soil and growing plants. By way of illustrating why plants contribute powerfully to increase evaporation, we may refer to the following data from Durand-Claye giving the relation between the evaporating surface of a number of agricultural crops and the unit area of the soil on which they grow:

Potatoes, ...	6.88	Wheat, . . .	10.95
Lucerne, ...	7.02 to 12.40	Grass, . . .	12.40
Rye, ...	6.50 to 8.24	Clover, . . .	16.36
Indian corn, . . .	8.00 to 22.40	Grape vines, . .	4.94
Branching cabbage, . .	8.00	Oak trees, . .	9.00
Oats, ...	9.11	Fir trees, . .	11.75

CONSUMPTION OF WATER BY GROWING AGRICULTURAL CROPS.

In a paper, *Recherches sur l'Evaporation du Sol et des Plantes*, Risler has given the results of further experiments at his estate in Switzerland, extending considerably the data of the paper already cited, his experiments being carried out specially with reference to ascertaining the mean daily consumption of water by growing agricultural plants, as well as by vineyards and two kinds of forests.*

The following matter relating to Risler's experiments is condensed from Ronna's *Les Irrigations*:

"By way of confirming the results of investigations as to the water consumed by growing plants, etc., carried out at the Agricultural Experiment Station of Rothamsted, England, Risler has shown the different methods employed by him in 1867 and 1868. By a continuation of these experiments in 1869–72, he has shown the mean daily consumption of water by lucerne, wheat, oats, clover, meadow grass, etc. One of his interesting conclusions is that winter wheat would have consumed daily, from April to July, 1869, 0.10 of an inch of water per day for 101 days, or over ten inches for the growing season. The experiments on water content of soil show that for the year 1869, the crops must have taken a small amount of water from the ground which, with the rainfall, was sufficient to produce a satisfactory crop for the meteorological conditions prevailing that year.

"For oats there was needed in 1870, according to Risler, a quantity of water 250 times the weight of dry material contained in the crop. In 1871, clover transpired 263 units of water to produce one unit of dry substance, and English ray-grass 545 units of water for one unit of hay containing fifteen per cent. of water. For this last the quantity of water corresponds to 0.276 inches in depth per day.

"Risler observed, furthermore, that, following rains or wettings, transpiration of plants increases, gradually diminishing in proportion as dryness increases, other conditions remaining equal. When the water given off by the leaves is less than that taken up by the roots, growth is active, while under the contrary conditions, plants wither.

"In a general way, the consumption of water by plants is more regular in clay soils than in sandy. Hellriegel states that in a sandy soil plants begin to suffer from drought when the soil does not contain more than 2.5 per cent. moisture. Risler finds that the approximate limit for clay soils is ten per cent., although in clay soil part of the water escapes absorption by the roots."

* Risler's experiments as detailed in the two papers cited may be taken as classical. Apparently they are the most thorough determinations thus far made. They are quoted with approbation by Durand-Claye in his *Hydraulique Agricole et Genie Rural*, and by Ronna in his recent work, *Les Irrigations*, and by other foreign writers. They have also been quoted by various American writers, but, so far as known to the author, the original papers have not been much studied in this country.

Taking as a basis the observations made on growing crops Risler concluded that the use of water for the growing season would be per day approximately as follows:

Meadow grass requires from			0.134 to 0.267	inches.
Oats	"	"	0.140 to 0.193	"
Indian corn	"	"	0.110 to 0.157	"
Clover	"	"	0.140	"
Wheat	"	"	0.106 to 0.110	"
Rye	"	"	0.091	"
Potatoes	"	"	0.038 to 0.055	"
Vineyards	"	"	0.035 to 0.031	"
Oak trees	"	"	0.038 to 0.035	"
Fir trees	"	"	0.020 to 0.043	"

"Risler determined the consumption of water on a meadow of one hectare (2.47 acres) of very thickly turfed English ray-grass as 281 millimeters (11.06 inches), amounting to a daily depth of 0.267 inches. This consumption applies to a meadow well provided with water during the warmest season of the year. The experiments showed that on cloudy days evaporation was reduced to about one-fourth of the mean, that is, to 0.069 inches per day.

"In Switzerland the fields begin to grow green the latter part of March, and the hay harvest occurs in June; hence the growth of the plant takes place in April and May. The amount of the hay crop, the rainfall and mean temperature during these months in the six years from 1866–72, as observed by Risler, are given in the accompanying table, which is generally self-explanatory. The point is brought out very forcibly by Risler's experiments, that hay crops depend more on the quantity of rain than on temperature; thus, in 1867, when the temperature of the two months was the lowest, but the rainfall high, the meadows yielded abundantly, while in 1868, with a high temperature, and medium rainfall, the crop was satisfactory because the soil had water in reserve, the drains continuing to flow until the end of May that year."

RISLER'S EXPERIMENTS ON THE YIELD OF MEADOWS.

YEAR	YIELD OF HAY PER ACRE IN POUNDS	RAINFALL IN INCHES		DATES WHEN DRAINS CEASED TO DELIVER WATER	TEMPERATURE. C°		
		IN APRIL AND MAY	MEAN PER DAY		IN APRIL	IN MAY	FOR THE TWO MONTHS
1866, . . .	3864	9.533	0.156	End of May	12.42°	13.70°	13.06°
1867, . . .	3375	10.078	0.165	End of May	10.67	13.11	11.89
1868, . . .	2842	4.248	0.070	End of May	9.00	18.72	13.86
1869, . . .	2753	6.303	0.103	End of March	10.80	15.67	13.23
1870, . . .	1288	1.271	0.021	End of March	9.80	16.12	12.96
1871, . . .	2975	3.864	0.063	End of April	11.20	13.91	12.46
Means, .	2849	5.883	0.096		10.62	15.20	12.91

DETERMINATION OF AMOUNT OF WATER CONSUMED BY PLANTS AT THE AGRICULTURAL EXPERIMENT STATION OF THE UNIVERSITY OF WISCONSIN.

Experiments extending over several years have been made at the Wisconsin Agricultural Experiment Station by F. H. King, the plan of the experiment being as follows: Galvanized iron cylinders eighteen inches inside diameter and forty inches deep were placed in pits with their tops flush with the surface of the ground in a field surrounded with growing crops of the same kind as those growing in the cylinders. Each experiment was conducted in duplicate.

Very careful determinations of the amount of moisture received by these cylinders were made by weighing them from time to time with a specially constructed weigh-master's beam, sensitive to 0.1 of a pound and carrying a weight of 600 pounds. Whenever the soil of the cylinders was likely to become too wet from the natural rain, shelters were provided to exclude it, otherwise the cylinders were exposed to the weather night and day. Careful weighings just before and after rains showed that the catch of water by the several cylinders did not materially differ among themselves and that they corresponded very closely to the result indicated by the rain gage.

In case of dry weather the water was added in weighed quantities as necessary to maintain the most vigorous growth of the plants. In the case of the experiments on corn, the surface of the ground was stirred to correspond with the field conditions, but otherwise no effort was made to check surface evaporation.

The following table gives the means of all the experiments made from 1891 to 1894, inclusive:

KIND OF CROP	NUMBER OF TRIALS	DRY MATTER PER ACRE. IN TONS	WATER PER ACRE PER TON OF DRY MATTER. IN INCHES	TOTAL DEPTH OF WATER PER SEASON. IN INCHES
Dent corn,	4	8.89	2.64	23.46
Flint corn,	4	11.20	2.14	23.96
Red clover,	3	4.29	4.03	17.29
Barley,	3	4.83	3.43	16.57
Oats,	6	4.79	5.29	25.32
Field peas,	1	3.58	4.21	15.07
Potatoes,	8	5.13	4.79	24.60

In the experiment on barley, made in 1891, the amount of water consumed in inches in depth on the ground area was found to be 13.19, while in the experiment of 1892, 23.52 inches were consumed. Oats in 1891 gave 19.69 inches and 19.0 inches in 1892. Corn shows a large consumption in all the experiments, the quantity being 26.39 inches in 1891, and 25.09 inches in 1892. Clover in 1892 required a total depth of water of 29.73 inches. Field peas required 16.89 inches in 1892.

In the experiments on oats in 1891, the dry matter per acre amounted to 8,861 pounds, total depth of water being 19.69 inches. In 1892, with a total dry matter per acre of 8,189 pounds, the total depth of water required was nineteen inches. In 1894 the yield of dry matter per acre was much larger than the previous years, ranging from 10,350 pounds to 12,900 pounds, consumption of water ranging from 30.48 inches to 31.18 inches. The experiments on potatoes show ranges in dry matter per acre from 8,248 pounds to 13,370 pounds, depth of water on the ground area ranging from 21.31 inches to 27.06 inches.

In regard to the consumption of water by potatoes, Mr. King remarks that whatever may be said regarding the yields of dry matter it is evident enough from the data that potatoes used a very large amount of water and since the surface of the ground was kept dry during the whole season, very much the larger proportion of the water must have passed through the vines and only a small part of it could have been lost through the soil directly.

It is also pointed out that in regard to oats in all the experiments the total yield of dry matter was much larger in 1894 than in the previous years, the amount of watei used being also relatively higher; the experiments of 1891 and 1892, averaging 509.5

pounds of water for one pound of dry matter, while the average in 1894 is 593.2 pounds of water to one pound of dry matter, the general average of seven trials being 557.3 pounds of water to one pound of dry matter.

EXPERIMENTS ON WATER CONSUMPTION OF PLANTS AT THE IOWA AGRICULTURAL COLLEGE.

During the growing season of 1895, experiments on the water consumption of several agricultural crops were made at the Iowa Agricultural College by J. B. Weems and W. H. Heileman. The land selected for the experiments is part of the station farm, upon which were grown clover, corn, oats, potatoes and blue grass. Samples of soil were taken each week at different depths and the amount of moisture determined in the usual manner. The investigation began April 9 and ended October 29, 1895. The nature of the soil in the experimental fields was as follows:

Clover field. First two feet consisted of black loam of a uniform good quality; third foot being composed of fine gravel and gravel clay and the fourth of gravel and clay.

Corn field. First two feet were loam soil; third foot was a yellowish clay loam mixed with black loam, the fourth foot being of a yellow sandy loam.

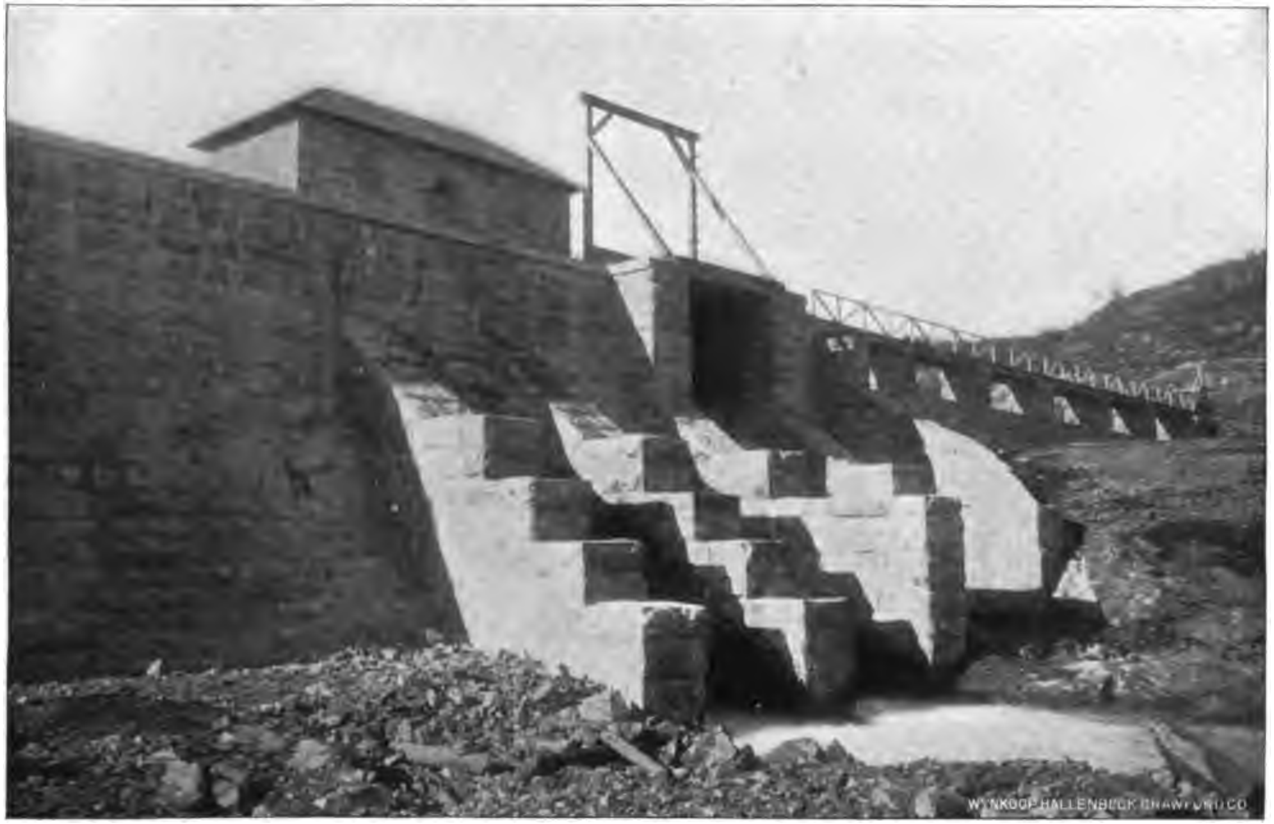
Oats field. First two feet consisted of a loam soil like the preceding, third foot being yellow loam mixed with black and the fourth foot consisted of yellow clay loam.

Root field. First two feet composed of the same soil as the preceding, with the third foot a black loam mixed with yellowish clay and the fourth foot consisting of stiff yellowish clay and fine gravel.

Blue grass meadow. First two feet consisted of a loam soil, the third being a fine sandy loam, brown in color, and the fourth foot composed of a fine sandy loam of yellowish color.

The results of the tests are shown by the following table:

KIND OF CROP	PERIOD CONSIDERED	TOTAL RAINFALL. IN INCHES	MOISTURE TAKEN FROM GROUND. IN INCHES	TOTAL WATER CONSUMPTION. INCHES ON GROUND AREA
Clover meadow,	April 9 to October 29,	25.08	2.48	27.56
Corn field,	May 7 to September 17,	19.27	2.12	21.39
Oat field,	April 9 to July 18,	13.09	3.97	17.06
Root field mangels,	May 21 to October 15,	19.86	1.39	21.25
Blue grass meadow,	April 9 to October 29,	25.08	3.41	28.49



INDIAN RIVER DAM. LOWER SIDE.

A detailed study of the Iowa tests shows that clover makes a very constant demand upon the soil for moisture, due possibly to some extent to the nature of the soil, but also due to the fact that clover is a uniform feeder, sending its roots to a great depth in the soil. The experiments in the corn field indicate that the demands of corn from August 6 to 20 were very large. The experiments on the oat field indicate that the demand for water is the largest near the surface. The root crop yielded 17.5 tons per acre, which indicates a consumption of 1.21 inches of water on the ground area per ton of crop. In the blue grass meadow the consumption of water was very large, being somewhat greater than for clover.

In regard to the preceding experiments at the Wisconsin and Iowa Agricultural Colleges, it may be pointed out that probably in the dry climate of those States the amount of water transpired by plants is greater than under the more humid conditions of the eastern states. In any case the figures are valuable, not only as verifying the results of foreign investigators, but because they give results obtained under the conditions of climate in the United States.

EXPERIMENTS OF BALDWIN LATHAM.

Baldwin Latham, the English Sanitary Engineer, has stated* that beginning in June, 1870, he discharged sewage upon a definite area, planted with ray-grass, at the Beddington-Croydon sewage farm, the grass being so placed in a water-tight tank six inches deep, and provided with suitable underdrains, with means of collecting the run-off of the drains, that definite results could be obtained. From June 18, 1870, to June 12, 1871, a period of 360 days, during which time 20.03 inches of rain fell, the water evaporated from a square yard of surface amounted to a depth of 186.3 inches over the area in a year. Experiments on another plat during the year 1871-72, gave for a period of 370 days, with a rainfall of 24.98 inches, a total application of water amounting to a depth of 91.2 inches over the area. These experiments indicate what large quantities of water may be evaporated by grass crops, provided a full supply is furnished.

EVAPORATION FROM LONG AND SHORT GRASS.

Observations as to the evaporation from grass crops have been made at Emdrup, Denmark.† According to these observations the mean evaporation from a water surface for a period of eleven years was 27.9 inches. The mean evaporation from

* In discussion of Mr. O'Meara's paper "On the Introduction of Irrigation in New Countries, as Illustrated by Northern Colorado." Proc. Inst. C. E., Vol. LXXIII (1893).

† See Beardsmore's Manual of Hydrology, p. 296.

short grass for a period of eight years was 30.1 inches, while for long grass for a period of eight years the mean evaporation is given at 44.0 inches. Inasmuch as these interesting tabulations may be readily referred to in Beardmore's Hydrology, they are not reproduced here.

TRANSPIRATION OF PLANTS.

This division of the subject, while discussed extensively by the great botanical writers, Von Sachs, Kerner and Oliver, and others, has not as yet been reduced by the botanist to numerical relations. The best general discussion of the how and why plants transpire water, may be found in Kerner and Oliver's Natural History of Plants, where every phase of the question has been touched upon. Reference may also be made to Von Sach's Physiology of Plants, and Bessey's Botany, where various facts relating to the general subject and statements of experiments are given. Bulletin No. 7, Forestry Division of the United States Department of Agriculture—Forest Influences—may also be consulted. Among other interesting data there given, we may refer to Wollny's experiments on water transpiration of agricultural crops, which are of special interest, not only because they are recent determinations, but because of verifying the work of Risler and others. They are as follows:

CROP	GROWING PERIOD	TOTAL WATER. INCHES	DAILY CONSUMPTION OF WATER. INCHES
Winter rye,	April 20 to August 13, 1879,	11.44	0.109
Summer rye,	April 20 to August 14, 1880,	13.25	0.114
Barley,	April 20 to August 3, 1879,	12.00	0.114
Peas,	April 20 to August 3, 1879,	13.88	0.132
Oats,	April 20 to September 14, 1880,	15.12	0.103
Beans,	April 10 to September 10, 1880,	13.80	0.096
Red clover (first season)	April 20 to October 1, 1879,	13.56	0.083
Red clover (second season),	April 20 to October 1, 1880,	17.95	0.109

The following figures of water consumption of certain plants for the growing season, computed from the data of Hales, Schleiden, Schübler and Höhnel, and others, are also mostly derived from Bulletin No. 7 on Forest Influences, certain apparently incongruous data there given being omitted:

PLANT	TOTAL USE OF WATER. INCHES	WATER PER DAY. INCHES
Sunflower,	15.2	0.130
Cabbage,	14.4	0.120
Vineyard,	4.0	0.030
Hop vine,	5.6	0.050
Clover and oats (mixed),	12.7	0.098
Grass,	14.0	0.080
Beech trees,	9.2	0.050
Mixed forest,	3.8	0.021
White poplar,	7.7	0.051
Long grass,	40.7	0.166
Short grass,	27.4	0.112

The figures for long grass and short are based upon the determination made at Emdrup, Denmark, as cited on a previous page, and include the months from March to October, inclusive.

FOREST DATA.

Elaborate investigations on transpiration of forest trees were made by F. B. Höhnel at the Austrian Experiment Stations, in 1878, an abstract of which may be found in Bulletin No. 7, Forest Influences. From the figures there given, it appears that forest transpiration from day to day has a wide range. Thus, a birch standing in the open, and having 200,000 leaves, was calculated to have transpired on hot summer days from 700 to 900 pounds of water, while on other days not more than eighteen to twenty pounds. A thirty-five-old beech tree with 3,000 leaves, was computed to transpire about 2.5 pounds per day from June to November. Assuming that 1,600 such trees might be found on an acre, the total transpiration might amount to about 600,000 pounds per acre, for each growing season of 150 days. A fifty to sixty-year old beech, with 35,000 leaves, transpired about twenty-two pounds daily, and with 500 such trees on an acre, the transpiration for 150 days would amount to 1,650,000 pounds. This latter figure is equivalent to 7.28 inches on ground area.

The following table is derived from Höhnel's data given at page 79 of Bulletin No. 7, Forest Influences:

KIND OF TREE	RELATIVE TRANSPIRATION	TRANSPIRATION FOR GROWING SEASON. INCHES ON GROUND AREA
Ash,	100.00	9.18
Birch,	90.2	8.18
Beech,	89.7	8.13
Hornbeam (Ironwood),	86.0	7.75
Elm,	80.8	7.32
Maple,	69.1	6.24
Norway maple,	60.1	5.45
English oak,	67.9	6.15
Oak,	48.3	4.37
Aspen,	94.2	8.54
Alder,	91.6	8.30
Linden,	86.8	7.87
Larch,*	123.3	11.17
Norway spruce,	13.8	1.25
Scotch pine,	11.9	1.08
Fir (balsam),	9.2	0.83
Austrian pine,	6.9	0.63

The foregoing figures give an average transpiration for the deciduous trees mentioned of about 7.3 inches, while for the four conifers the average may be taken at about one inch. †

* This is probably the European larch. The American larch (tamarack) grows naturally in swamps and is, like the swamp ash, a large consumer of water. Tamarack is, however, a slow grower, and probably 11.17 inches per year is a large figure even for a swamp habitat.

† In the original table from which these data are derived, the results are in kilogrammes evaporated per 100 grammes of dry leaves. The data stated in this form not furnishing any basis for practical computation, in order to reduce them to inches on the ground area, the percents have been computed by assuming ash at 100, and the transpiration of the other species as proportionate to the number of kilogrammes per 100 grammes of dry leaves, in this way obtaining the second column of the table. Inches on the watershed have been computed from the data as to beech trees assuming the transpiration, for the growing season, of the average beech tree at 8.13 inches on the ground area, the other transpiration depths being made proportionate. The results in this form are, of course, only approximate, but are interesting as veryfying previous data. In any case, it should be borne in mind that with the infinite variations of climate and soil, such data are, and must ever remain, more or less approximative. These data are also given by Mr. Nisbett in his recent work, Studies in Forestry, but with figures differing somewhat from those in Bulletin No. 7. In the absence of Höhnel's original paper the author has no means of determining which set is right. In any case these figures are merely given for illustrative purposes, and slight variations do not therefore especially affect the final results. Moreover, it may be pointed out that "inches on the ground area" of this table are computed on the supposition that all forests have the same density as the assumed typical beech forest. As a matter of fact the density of different forests will vary greatly, the average being less than the beech. On this basis the figures for inches on the ground area are undoubtedly somewhat in excess of the truth.

As shown by all the recent experiments, evaporation from the surface of plant foliage is much less rapid per unit area than from water surfaces. An extended discussion of why this is so is given by Kerner and Oliver in their Natural History of Plants. As shown, however, by the data on page 419 the area of foliage is much greater than the ground area on which the plant stands, in the case of Indian corn the increase in area amounting, as a maximum, to 22.4 times the ground area. It is because of this immense transpiring or evaporating surface that some plants throw off more water than can be evaporated from the ground area on which they stand.

In concluding this part of the subject the deduction may be tentatively drawn from the foregoing data that hardwood forests may consume from about five to ten inches in depth of water over the ground area in each growing season. Probably from six to eight inches is a fair average for deciduous forests, although broad-leaved forests may consume somewhat more. The most of the evergreens are small water consumers, the larch being, however, an exception. Spruce and pine forests apparently require only a few inches on the ground area per year. In order to insure enough we may allow them from four to six inches per year.

The figures show, therefore, that the kind of forest must be taken into account in estimating the effect on yield of streams.

As regards cultivated crops the figures show demands for about twelve to fifteen to twenty inches on the ground area for cereals and grass crops. For vineyards, and hop yards the tabulated figures may be increased by at least fifty per cent. to cover evaporation from the naked soil between the plants, thus giving about eight to eleven inches for these two agricultural crops. Everything goes to show that for grass crops the consumption of water is very large, clover transpiring from 13.6 inches to 18.0 inches, and grass crops even more than this. As shown by the experiments of Baldwin Latham, Italian ray-grass will, when given a full water supply, use up in one year several times the average annual rainfall of this State.

As a final tentative proposition we may say, therefore, that highly cultivated farming areas will consume in surface evaporation and plant transpiration from two to three times as much water as average deciduous forests, and from three to five times as much as average evergreen forests. In mixed forests the water consumption will depend upon the relative proportion of the different kind of trees.

CLIMATIC LIMIT OF FOREST GROWTH UNDER NATURAL CONDITIONS.

In his Report on the Forests of North America for the tenth census, Professor Charles S. Sargent discusses, in his introductory chapter, the reasons why there are no forests upon the prairies of Minnesota, Wisconsin, Iowa, Illinois and Missouri, taking the ground that other influences than insufficient rainfall have prevented the general growth of trees in these prairie regions. The rainfall, Professor Sargent says, is sufficient to insure a heavy growth of forest here. The soil of the prairie is not unsuited to tree growth, as is proven by a vigorous and rapid growth when trees are planted, nor is it want of sufficient heat or equally distributed moisture which has checked the growth of forest over these prairies. Professor Sargent expresses the opinion that the forests of the Atlantic region once extended continuously as far west at least as the ninety-fifth meridian, although he is unable to cite decisive evidence that this is true. It is Professor Sargent's opinion that we must trace the destruction of the forest over this area to accidental causes. Among others he mentions forest fires and the force of the wind, which would make the spread of forest growth slow and difficult.

Professor Sargent says the assumption that these eastern prairies may have once been covered by forests is strengthened by the fact that since they have been devoted to agriculture and the annual burning stopped, trees which were formerly confined to the river bottoms have, in many cases, gradually spread to the uplands. In many places small prairies just within the edge of the forest have entirely disappeared within the memory of persons still living. In western Texas the mesquit, forced by annual burning to grow almost entirely below the surface of the ground, is now, that forest fires are less commonly destructive, spreading over what was formerly a treeless prairie.

There is a popular view that forests cease to be abundant when rainfall becomes less than thirty-two inches per annum and practically disappear when the rainfall becomes as low as twenty-six inches. In many places less than twenty inches of rainfall is apparently accompanied by an exclusively pastoral country and with less than fourteen inches rainfall vegetation at many places in the West practically disappears. Facts of this character have been cited to indicate that forests do not thrive with less moisture than other vegetation, but such facts, when examined, are susceptible of another interpretation. We must take into account very many conditions besides that of the rainfall. Indeed, when we study the question broadly we find that in many places in the West there are forest growths with comparatively very slight rainfalls. On this point we may cite experience in California.

In 1885, the California Legislature created the State Board of Forestry, which established two forestry stations, one at Chico, in the northern part of Sacramento Valley, and the other at Santa Monica, in the southern part of the State. The Chico station is in a region where trees were found growing naturally when the first settlements were made in California. The rainfall at Chico by five year periods, from 1871 to 1895, inclusive, was as follows:

PERIOD.	MEAN RAINFALL IN INCHES.
1871 to 1875,	21.6
1876 to 1880,	22.6
1881 to 1885,	18.6
1886 to 1890,	20.8
1891 to 1895,	27.9
Mean,	22.3

The mean annual temperature at Chico for the years 1891 to 1896, inclusive, was as shown by the following tabulation:

	F°
1891,	65.1
1892,	62.1
1893,	59.6
1894,	61.2
1895,	64.0
1896,	63.0
Mean,	62.5

At the Santa Monica station the climatic conditions are much less favorable than at Chico, the mean temperature and rainfall being for the years 1891 to 1896, inclusive, as per the following table:

YEAR.	TEMPERATURE. F°.	RAINFALL. INCHES.
1891,	62.3	15.68
1892,	60.2	16.28
1893,	60.4	19.25
1894,	58.4	6.73
1895,	60.3	11.56
1896,	66.7	11.97*
Means,	61.4	13.58

* Rainfall for September missing from record.

The area devoted to forestry experiments at this place is divided into three distinct terraces, the lowest lying in a creek valley and presumably receiving water by absorption from the stream; the middle terrace receives a small amount of water from springs; while the upper terrace is entirely without any opportunity for artificial supply of water. Trees have been successfully grown on all three terraces. In the annual report of the agricultural experiment stations of the University of California for the years 1895-96, 1896-97, it is stated that there are few places in California where the climate is as favorable for the successful culture of a large number of species of plants and trees as it is at Santa Monica. The records show, however, that in extremely dry years trees sometimes suffer from drought.

The experience gained at these two California forestry stations is specially interesting because there are at both of them several months in the year when there is absolutely no rainfall. Thus, at Chico, in 1892, there was no rainfall in the months of June, July, August and September. At Santa Monica, in 1892, rainfall was entirely absent from June to October, inclusive. At Santa Monica, in 1895, the rainfall of May was 0.08 inches, June, July, August and September, nothing and October 0.18 inches.

The reasons why forest and other trees grow under such conditions of slight rainfall are explained by Professor E. W. Hilgard in Bulletin No. 121 of the University of California Agricultural Experiment Station—The Conservation of Soil Moisture and Economy in the Use of Irrigation Water. Professor Hilgard says that the surprisingly successful growth of deciduous trees without irrigation in California and despite a drought of five or six months, leads to the conclusion that a less amount of water may suffice under arid conditions, especially since in the East a few weeks of drought will frequently destroy many kinds of trees.

As to why forest trees endure drought better in California than in the East, Professor Hilgard points out that the main cause is to be found in the much deeper rooting of all plants in that arid climate whereby not only a much larger bulk of moist soil is at their command, but the roots are withdrawn from the injurious effects of the hot, dry surface and air.

Professor Hilgard says this deeper rooting is not the result of foresight on the part of the plant; it could not occur on eastern soils because in the majority of the cases the subsoils are impenetrable. On the other hand, in California, as a rule, subsoils in the eastern sense do not exist; the soil mass is practically the same for several feet and is very readily penetrable to great depths. This is due to the slight formation of clay and the rarity of heavy rains in California. Moreover, this easy penetrability of the soil implies that being well aerated the depths of the soil are not raw as in the East and that, therefore, the subsoil may fearlessly be turned up as deeply as the farmer is

willing to go without danger of injuring the next season's crop, as by reason of their depth and perviousness is the case with most California soils.

In illustration of these views Professor Hilgard submits two views of typical root systems at the East and in California. In the first the roots are shown branching out laterally, as is the case of all tree growth, especially in the State of New York, and only penetrating a very few feet. In the illustration of tree root growth in California, he shows a photograph of a prune tree grafted on a peach root where the main roots extend down nearly vertically into the ground to a depth of from seven to ten feet.

It seems clear, therefore, that, as a result of these California studies, we must amend our view that forest trees will not grow in regions with deficient rainfall. Obviously the controlling condition is penetrability of soil rather than quantity of precipitation. These facts also lead to the tentative conclusion that forests require for growth considerably less water than agricultural crops, although it may be borne in mind that vigorous growth in forests, the same as in agriculture, is stimulated by an abundant water supply.

HYGROMETRIC OBSERVATIONS AT THE MAINE STATE COLLEGE AGRICULTURAL EXPERIMENT STATION.

The agricultural experiment station of the Maine State College at Orono, Maine, has kept a record of hygrometric conditions at two points in the open field and at two points in a neighboring forest for the growing season, April to October, inclusive, for a number of years. The following explanatory matter relating thereto is derived from the Annual Reports of the Maine State College:

Hygrometer No. 1 is placed in a wooden stand constructed for thermometrical instruments, located in an open field remote from buildings. No. 2 is enclosed in a wooden box, perforated to allow a free circulation of air, and also located in the open field. No. 3 is enclosed in a perforated box attached to a tree in a moderately dense forest. No. 4 is placed in a similar box attached to a tree in a portion of the forest a little more open than that in which No. 3 is located, but near which is a running brook except during the driest part of the summer.

Each hygrometer is about four feet above the surface of the ground. Readings are taken three times daily, at 7 A.M., 1 P.M. and 7 P.M., local time.

Observations began April 5, 1889, and were continued through the growing seasons of 1889, 1890, 1891 and 1892.

The monthly averages are given in the following tables on the scale of 100.

Hygrometer No. 1. In Open Field.

MONTH	1889			1890			1891			1892			MEAN
	7 A.M.	1 P.M.	7 P.M.	7 A.M.	1 P.M.	7 P.M.	7 A.M.	1 P.M.	7 P.M.	7 A.M.	1 P.M.	7 P.M.	
April,	81	53	66	74	50	58	85	61	67	74	47	57	64
May,	84	60	71	81	62	74	82	57	67	78	63	67	71
June,	88	67	81	83	72	75	83	62	71	86	69	74	76
July,	85	65	75	85	74	79	87	61	72	84	57	69	74
August,	95	70	80	90	63	77	89	67	83	92	70	80	80
September,	93	68	83	93	76	85	92	67	84	97	61	81	82
October,	94	66	79	90	62	79	90	63	80	86	64	76	77
Means,	89	64	76	85	66	75	87	63	75	85	62	72	75

Hygrometer No. 2. In Open Field.

Month	1889			1890			1891			1892			Mean
	7 A.M.	1 P.M.	7 P.M.	7 A.M.	1 P.M.	7 P.M.	7 A.M.	1 P.M.	7 P.M.	7 A.M.	1 P.M.	7 P.M.	
April,	78	52	65	70	46	56	84	62	70	74	50	63	64
May,	80	53	68	78	61	74	80	55	68	78	63	70	69
June,	84	66	74	78	68	75	82	62	73	84	67	73	74
July,	79	60	69	80	63	71	86	62	75	82	55	67	71
August,	87	67	75	88	62	73	87	65	80	90	68	81	77
September,	91	60	81	91	67	83	91	67	85	92	60	81	79
October,	93	66	81	91	62	79	91	65	82	83	64	77	78
Means,	85	61	72	82	61	73	86	63	76	83	61	73	73

Hygrometer No. 3. In Forest.

Month	1889			1890			1891			1892			Mean
	7 A.M.	1 P.M.	7 P.M.	7 A.M.	1 P.M.	7 P.M.	7 A.M.	1 P.M.	7 P.M.	7 A.M.	1 P.M.	7 P.M.	
April,	81	62	60	78	61	69	90	73	77	83	63	71	72
May,	83	63	73	87	74	81	86	68	75	86	71	76	77
June,	89	80	84	87	77	82	88	81	84	91	78	82	73
July,	94	86	91	93	85	83	92	80	85	92	74	81	86
August,	91	89	93	94	80	84	95	81	88	96	85	89	89
September,	96	88	92	96	87	92	93	81	92	96	77	88	88
October,	96	90	90	96	86	90	92	77	86	90	80	85	88
Means,	90	80	85	90	79	83	91	77	84	91	75	82	82

Hygrometer No. 4. In Forest.

Month	1889			1890			1891			1892			Mean
	7 A.M.	1 P.M.	7 P.M.	7 A.M.	1 P.M.	7 P.M.	7 A.M.	1 P.M.	7 P.M.	7 A.M.	1 P.M.	7 P.M.	
April,	83	65	77	79	60	71	91	74	82	84	65	75	75
May,	89	66	80	88	73	84	87	69	78	87	74	77	79
June,	92	81	86	89	77	84	90	74	82	92	79	84	84
July,	93	79	87	91	79	85	93	79	86	94	72	80	85
August,	95	86	91	91	78	85	96	78	90	97	86	90	89
September,	96	83	90	97	86	92	96	76	92	95	76	87	88
October,	96	80	90	94	80	89	92	75	87	91	79	86	87
Means,	92	77	86	90	76	84	92	75	85	91	76	81	84

The percentages of moisture contained in the atmosphere, obtained by combining the preceding tables for 1889, 1890, 1891 and 1892, are as follows:

	7 A.M.	1 P.M.	7 P.M.	MEAN.
Hygrometer No. 1, in open field, . . .	86	64	75	75
Hygrometer No. 2, in open field, . . .	84	62	73	73
Hygrometer No. 3, in forest, . . .	90	78	84	84
Hygrometer No. 4, in forest, . . .	91	76	84	84

Regarding the mean results from Nos. 1 and 2 as indicating percentages for the open field, we have the following:

	7 A.M.	1 P.M.	7 P.M.	MEAN.
Percentages of moisture, open field, . . .	85	63	74	74

Regarding the mean results from Nos. 3 and 4 as indicating percentages of forests only moderately dense, we have the following:

	7 A.M.	1 P.M.	7 P.M.	MEAN.
Percentages of moisture, forest, . . .	91	77	84	84

Comparing results, open field and forest, we have excess of moisture in forest above that in open field expressed in percentages:

7 A.M.	1 P.M.	7 P.M.	MEAN.
6	14	10	10

In discussing these results in the Annual Report of the Maine State College for 1892, President Fernald, meteorologist to the agricultural experiment station, states that it appears from the foregoing observations covering the growing period, April–October, inclusive, that the excess of moisture in the forest above that of open fields amounts in the morning to six per cent.; in the middle of the day it rises to fourteen per cent.; at nightfall drops to ten per cent.; and that the mean excess for the day is about ten per cent. Hence, it is concluded that the presence of patches of forests in any region exerts a marked influence on the hygroscopic conditions of the atmosphere, which condition, in turn, is an important factor in the growth of vegetation.

The foregoing conclusion by President Fernald is certainly justified, if such differences exist between the percentage of moisture present in the air in the open and in forest as is shown by the Orono observations.

VALUE OF THE NUMERICAL DATA OF FORESTS IN RELATION TO STREAM FLOW.

Recently some students of forestry have been disposed to say that, as yet, the data are insufficient for expressing even approximately the numerical relation between forests and stream flow, and that the whole question of forest influence must, therefore, be held in abeyance for many years. As regards this position the author suggests that a study of this character which does not reduce physical data to numerical relations is somewhat unscientific. The object of scientific investigation, especially on the lines now under discussion, is not to pile up isolated facts, but to obtain practical information for immediate use. Especially is this view pertinent in the State of New York, where the Commonwealth has embarked in an expenditure of several million dollars for forest conservation. We need, therefore, numerical values of some sort at once in order to determine approximately what results may be expected from forest conservation in the Adirondack Park as regards influence on streams. While, therefore, the data herein given are only approximate and the conclusions necessarily tentative, the author is still of the opinion that they on the whole do strongly tend to justify the position that forested areas in the State of New York will yield considerably more water as run-off in the streams from a given rainfall than will deforested areas. This position is, however, only tentative and subject to modification with the gathering of more com lete data.

AN EVENING SHOT.

The State's Title to Lands in the Forest Preserve.

By EDWARD H. LEGGETT.*

THE FIRST TRACKING SNOW.

DURING the past year litigation of very great importance relating to State land titles in the Forest Preserve has been carried on in the Supreme Court of the United States, in the United States Circuit Court, in the Court of Appeals and the Supreme Court of this State.

The Commission, through its able and learned counsel, assisted by the Attorney-General of the State, has been successful in each of these suits. A summary of the most interesting cases is submitted herewith:

In the case of Benton Turner, plaintiff in error, against the People of the State of New York, defendants in error (United States Supreme Court), the issues raised involved the constitutionality of a law of this State (chapter 448 of the Laws of 1885), an act which in substance limits the time within which actions shall be brought to test the title of purchasers of non-resident lands sold at tax sales, when the actions commenced are based upon alleged irregularities in tax sales and conveyances. This case was of importance as involving the title of the State not only to the lands involved in the action itself but also the State's title to several hundred thousand acres of land in the Forest Preserve, which had been bid in for the State at various tax sales.

* Of the Attorney-General's Department.

Actions of this kind heretofore brought have frequently been based upon two propositions, the one being that certain irregularities were jurisdictional in their nature, and the other that the act itself was unconstitutional in that it deprived owners of their property without due process of law, more especially for the reason that the time prescribed by the statute for the commencement of actions was too brief; and, for the further alleged reason that, so far as the State is concerned, no provision has been made for suing the State.

Mr. Turner, the plaintiff in error, first had litigation with the State concerning the State's title to the land known as Lot No. 219, Township No. 10, Franklin county. In this action he was defeated. The case is reported in 117 N. Y., 227. The land in controversy in the action which went to the Supreme Court of the United States, consisted of about 7,500 acres, being the southeast quarter of Township No. 24, Great Tract 1, Macomb's Purchase, Town of Harrietstown, Franklin county. These lands were bought by the State upon a tax sale held October 12, 1877, for unpaid taxes for the years 1866 to 1870, inclusive, and were conveyed to the State by a Comptroller's deed, dated June 9, 1881, recorded June 8, 1882. Mr. Turner obtained a deed of this property from one John B. Reilly, December 27, 1886, Reilly having secured a conveyance the same year from the heirs of one Norton, who owned the property at the time of the tax sale. Turner, also, upon June 8, 1887, bought the premises at a sheriff's sale upon a judgment obtained against the former owner of the land ten years before, and attempted to denude the land of the timber upon it. In an action of replevin brought against Turner, in the name of the People, through the Forest Commission, to recover the timber which he had cut upon these lands, he defended, alleging that the title of the State was invalid.

Having been defeated in all the State Courts (People *v.* Turner, 145 N. Y., 451) the case was taken to the Supreme Court of the United States, which Court held by unanimous vote, that the statute under consideration was in no way in contravention of the Federal Constitution. Mr. Turner thereafter made an application for a re-argument in that Court, which was denied; and, subsequently, upon the filing of the mandate of the Supreme Court of the United States with the Court of Appeals, made an application for re-argument in this Court, which was also denied January 18, 1898. It is believed that the decisions of this case will quiet the title of the State to the lands in the Forest Preserve, and, it is hoped, will prevent further litigation upon that question. (A copy of the opinion of the Supreme Court of the United States in this case is appended.)

Since the above decision the matter in controversy has been definitely settled in favor of the State in the case of The People *ex rel.* The Forest Commission *vs.* Campbell, Comptroller.

The Saranac Land and Timber Company against James A. Roberts, Comptroller (United States Circuit Court, Northern District of New York), was an action brought by a New Jersey corporation to recover possession of 7,500 acres of land, including the Lower Saranac Lake with its valuable shores and islands, which was purchased by the State at tax sales. The plaintiff alleged numerous defects in the tax title of the State, claiming that they were jurisdictional in their nature, and rendered the title of the State nugatory. Voluminous testimony was taken upon the trial, and the court, in its decision rendered November 12, 1897, held that the alleged defects were irregularities, which were cured by the short statute of limitations (chapter 448, Laws 1885), and the complaint was dismissed with costs. A copy of Judge Cox's opinion is appended. The case is now pending in the United States Supreme Court on bill of exceptions taken on the trial.

The case of the People, etc., *ex rel.* John H. Millard and George N. Ostrander against James A. Roberts as Comptroller (Court of Appeals), was an appeal from an order of Appellate Division, Third Department (8 App. Div. 219), affirming the Comptroller's decision in a proceeding instituted by writ of certiorari, April 24, 1893, to review the determination of ex-Comptroller Frank Campbell, in denying the application of the petitioners for the cancellation of the 1881 tax sale to the State of 585⅜ acres in the northwest quarter of Township 27, in Great Tract 1 of Macomb's Purchase, Franklin county, adjoining Ampersand Pond.

The order appealed from was affirmed by the Court of Appeals, January 26, 1897 (151 N. Y. 541), upon the ground that under no circumstances, even though the State might be the purchaser at the tax sale, did the Comptroller have jurisdiction to cancel a tax sale upon the application of a former owner. The court said: "If the sale is invalid, the owner's title is not affected, and he may keep and defend his possession, or, if put out of possession, he may regain it by action of ejectment."

The lands in question in the last above-mentioned case were again put in controversy by Ferris J. Meigs, who purchased the interests of Millard and Ostrander, in the following action:

"Ferris J. Meigs against James A. Roberts, Comptroller."

This action was commenced in the Supreme Court, Franklin county, to eject the State from a tract of land comprising about 585 acres, in the north part of the northwest quarter of Township 27; in Great Tract No. 1 of Macomb's Purchase, adjoining Ampersand Pond, the title to which the State had acquired by purchase at tax sales in 1881 and 1885. The questions at issue were heard before Mr. Justice Russell, at Special Term, November 30, 1898, who, in a written opinion, decided against the plaintiff; and judgment was accordingly entered. From this judgment appeal was taken to the Appellate Division, Third Department. Judge Russell said

in his opinion: "I decide and find that the complaint in the above entitled action should be dismissed upon the grounds: That the land in controversy to recover which the action has been brought, are within the Forest Preserve of the State of New York, and are claimed, and held by said State under certain tax sales; that the Commissioners of Fisheries, Game and Forests have, by authority of statute, the care, custody, control and superintendence of said lands; that the Comptroller of the State is not in such possession or occupancy either constructive or actual of the lands in the

WHERE THE DEER COME TO FEED.

Forest Preserve, including the lands in question, that the title of the State to said land can be tested in an action of ejectment brought against said Comptroller; that the State has not given its consent that its title to land in the Forest Preserve or its possession thereof can be questioned or tested by way of an action of ejectment against the Comptroller of the State; that the statutory provisions authorizing the Comptroller to advertise once a week, for at least three weeks successively a list of the wild, vacant and forest lands to which the State holds title, does not give the State's consent that the Comptroller place himself in such possession of lands so advertised

that the title of the State to said lands can be questioned or tried in an action against said Comptroller, and there is no legal authority for the commencement of such an action against the Comptroller for the purpose of determining the title of the State to wild, vacant and forests lands; that a judgment against the Comptroller would not disturb or affect the title of the State to the lands described in the complaint."

The final determination of this case will be of vast importance; because there are suits now pending involving substantially the same question and affecting some sixty-three thousand acres of land in the Forest Preserve.

The case of Smith M. Weed, *et. al.*, against James A. Roberts, as Comptroller, and Barnet H. Davis and others, as Commissioners of Fisheries, Game and Forests, was an injunction suit in the Supreme Court, Franklin county, to restrain the Comptroller from acting upon, and the Commissioners of Fisheries, Game and Forests from prosecuting, an application to the Comptroller, pursuant to chapter 392, of the Laws of 1897, to set aside certain cancellations, made by a former Comptroller, of tax sales to the State in 1877, 1881 and 1885, of 6,280 acres of land in the southeast quarter of Township 23, Great Tract 1 of Macomb's Purchase, in Franklin county, adjoining Upper Saranac Lake. These cancellations were made on April 11, 1892, on the application of a person other than the purchaser at the tax sales, and without authority of statute. The application for a temporary injunction was argued before the Hon. Chester B. McLaughlin, J. S. C., who handed down his decision on December 24, 1897, denying the application upon the following grounds:

"*First:* It does not appear that the application for cancellation will be prejudicial to plaintiff's rights.

"*Second:* Chapter 392 of the Laws of 1897 is not unconstitutional.

"*Third:* The Comptroller's decision, if adverse to the plaintiff, may be reviewed by certiorari.

"*Fourth:* Plaintiffs have an adequate remedy at law. If the tax sale is invalid, plaintiff's title is not affected. They may keep and defend their possessions, or if put out of possession, may regain it by ejectment.

"Finally, a court of equity will not entertain a suit to prevent a cloud upon title, unless it be made to appear that there was a determination on the part of the defendants to create the cloud, and the danger must not be merely speculative, but be real."

In addition to these cases there were several others which have been decided in the Supreme Court, and the opinions of the court therein are also submitted herewith:

SUPREME COURT OF THE UNITED STATES.

No. 41.—October Term, 1897.

Benton Turner, Plaintiff in Error, *vs.* The People of the State of New York.	In error to the Court of Appeals of the State of New York.

This was an action of replevin, brought April 11, 1887, in behalf of the State of New York by the forest commissioners of the State against Turner, in the Supreme Court of the county of Franklin and State of New York, to recover a quantity of logs cut by him upon lands in that county and within the forest preserve of the State, between September 1, 1886, and March 25, 1887. The answer denied the allegations of the complaint, and alleged that at the time mentioned therein the defendant was the owner and in possession of the lands.

The material facts of the case, as found by a referee, were as follows: On October 12, 1877, the lands, being then owned by one Norton, were sold by the Comptroller of the State of New York for unpaid taxes of the years 1866 to 1870 inclusive, and were bid in by the Comptroller in behalf of the State, and conveyed by him to the State by deed dated June 9, 1881, and recorded June 8, 1882. The defendant, more than nine years after that sale, acquired Norton's title in the land. The land was wild forest land, uncultivated, unimproved, unenclosed, and with no dwelling house or other building thereon. Neither the State nor any officer thereof ever took actual possession of the land; and no part of it was in occupancy of any person on October 12, 1879, when the period of two years allowed by law for redemption from the Comptroller's sale expired.

At the trial before the referee, the defendant, in order to prove the invalidity of the Comptroller's deed by reason of illegality in the assessment of the taxes for the years 1867 and 1870, offered to show that the oath of the assessors to the assessment roll of 1867 was taken on August 10, instead of on the third Tuesday of August; and that the assessors omitted to meet on the third Tuesday of August, 1870, to review their assessments for that year.

The plaintiff objected to the evidence as immaterial, because the Comptroller's deed was made conclusive evidence of those matters by the statute of New York of 1885, c. 448, which is copied in the margin.* The defendant contended that this statute was invalid as contrary to

* An Act to amend chapter four hundred and twenty-seven of the laws of eighteen hundred and fifty-five, entitled "An act in relation to the collection of taxes on land of non-residents and to provide for the sale of such lands for unpaid taxes."

Sect. 1. Section sixty-five of chapter four hundred and twenty-seven of the laws of eighteen hundred and fifty-five, entitled "An act in relation to the collection of taxes on lands of non-residents and to provide for the sale of such lands for unpaid taxes," is hereby amended so as to read as follows:

§ 65. Such conveyances shall be executed by the Comptroller, under his hand and seal, and execution thereof shall be witnessed by the treasurer or deputy comptroller; and all such conveyances that have been heretofore executed by the Comptroller, and all conveyances of the same lands by his grantee or grantees therein named, after having been recorded for two years in the office of the clerk of the county in which the lands conveyed thereby are located, and all outstanding certificates of a tax sale heretofore held by the Comptroller that shall have remained in force for two years after the last day allowed by law to redeem from such sale shall, six months after this act takes effect, ***be conclusive evidence that the sale and all proceedings prior thereto***, from and including the assessment of the land,

the first section of the Fourteenth Article of Amendment to the Constitution of the United States. But the referee sustained the plaintiff's objection to the evidence, and directed judgment for the plaintiff, which was accordingly rendered by the court, and affirmed by the Court of Appeals. 145 N. Y. 451. The defendant sued out this writ of error.

[October 18, 1897.]

Mr. Justice GRAY, after stating the case, delivered the opinion of the court.

On May 15, 1885, the legislature of New York, by the statute of 1885, c. 283, declared that all the lands then owned or thereafter acquired by the State of New York within certain counties (one of which was Franklin county) should constitute and be known as the Forest Preserve; and established a forest commission of three persons, styled forest commissioners, to "have the care, custody, control and superintendence of the forest preserve," and "to maintain and protect the forests now in the forest preserve, and to promote as far as practicable the further growth of forests thereon"; and authorized them to appoint a warden and other officers, and to exercise various powers to carry out its object.

At the date of the passage of that statute, the time allowed by law for the redemption of lands from sale by the Comptroller for nonpayment of taxes was two years from the time of sale. New York Stat. 1855, c. 427, §50.

On June 9, 1885, the legislature of the State passed the statute of 1885, c. 448, to take immediate effect, which provided that all conveyances, thereafter executed by the Comptroller, of lands, in the same counties, sold by him for non-payment of taxes and having been recorded for two years in the clerk's office of the county in which the lands lay, should, "six months after this act takes effect, be conclusive evidence that the sale and all proceedings prior thereto, from and including the assessment of the land, and all notices required by law to be given previous to the expiration of the two years allowed by law to redeem, were regular" and as required by law; but that all such conveyances and the taxes and tax sales on which they were based, should "be subject to cancellation, as now provided by law, on a direct application to the Comptroller, or in an action brought before a competent court therefor, by reason of the legal payment of such taxes, or by reason of the levying of such taxes by a town or ward having no legal right to assess the land on which they are laid."

---

and all notices required by law to be given previous to the expiration of the two years allowed by law to redeem, were regular and were regularly given, published and served according to the provisions of this act, and all laws directing or requiring the same or in any manner relating thereto; and all other conveyances or certificates heretofore or hereafter executed or issued by the Comptroller, shall be presumptive evidence of the regularity of all the said proceedings and matters hereinbefore recited, and *shall be conclusive evidence thereof from and after the expiration of two years* from the date of recording such other conveyances, or of four years from and after the date of issuing such other certificates. But all of such conveyances and certificates and the taxes and tax sales on which they are based shall be subject to cancellation, as now provided by law, on a direct application to the Comptroller, or in an action brought before a competent court therefor by reason of the legal payment of such taxes, or by reason of the levying of such taxes by a town or ward having no legal right to assess the land on which they are laid.

SECT. 2. The provisions of this act are hereby made applicable only to the following counties, viz., Clinton, Delaware, Essex, Franklin, Fulton, Greene, Hamilton, Herkimer, Lewis, Saratoga, St. Lawrence, Sullivan, Ulster, Warren and Washington, but shall not affect any action, proceeding or application pending at the time of its passage; nor any action that shall be begun, proceeding taken or application duly made within six months thereafter for the purpose of vacating any tax sale or any conveyance or certificate of sale made thereunder.

SECT. 3. This act shall take effect immediately.

The land now in question was sold by the Comptroller to the State, October 12, 1877; the time allowed by law for redeeming the land from that sale expired October 12, 1879; the Comptroller's deed to the State was made June 9, 1881, and recorded June 8, 1882. It had therefore been on record for three years when the statue of June 9, 1885, was passed and took effect; and by the terms of this statute, on December 9, 1885, the Comptroller's deed became conclusive evidence that there was no irregularity in the assessment of any of the taxes for non-payment of which the land had been sold and conveyed to the State. This action was brought April 11, 1887.

The statute, according to its principal intent and effect, and as construed by the Court of Appeals of the State, was a statute of limitations. *People* v. *Turner*, 117 N. Y. 227; *Same* v. *Same*, 145 N. Y. 451. It is well settled that a statute shortening the period of limitation is within the constitutional power of the legislature, provided a reasonable time, taking into consideration the nature of the case, is allowed for bringing an action after the passage of the statute and before the bar takes effect. *Terry* v. *Anderson*, 95 U. S. 628, 632, 633; *In re Brown*, 135 U. S. 701, 705–707.

The statute now in question relates to land sold and conveyed to the State for non-payment of taxes; it applies to those cases only in which the conveyance has been of record for two years in the office where all conveyances of lands within the county are recorded; and it does not bar any action begun within six months after its passage. Independently of the consideration that before the passage of the statute the plaintiff had had eight years since the sale, and three years since the recording of the deed, during which he might have asserted his title, this court concurs with the highest court of the State in the opinion that the limitation of six months, as applied to a case of this kind, is not repugnant to any provision of the Constitution of the United States.

It was argued in behalf of the plaintiff in error that the statute was unconstitutional, because it did not allow him any opportunity to assert his rights, even within six months after its passage. But the statute did not take away any right of action which he had before its passage, but merely limited the time within which he might assert such a right. Within the six months, he had every remedy which he would have had before the passage of the statute. If he had no remedy before, the statute took none away. From the judgment of the Court of Appeals in the case at bar, and in the subsequent case of *People* v. *Roberts*, 151 N. Y. 540, there would appear to have been some difference of opinion in that court upon the question whether his proper remedy was by direct application to the Comptroller to cancel the sale, or by action of ejectment against the Comptroller or the Forest Commissioners. But as that court has uniformly held that he had a remedy, it is not for us to determine what that remedy was under the local constitution and laws.

It was also argued that the plaintiff in error was in possession of the land and could not be put to his action. But the decision below that he was not in possession involved no Federal question, or any other question of law, but a mere inference of fact from the evidence, which this court is not authorized to review on writ of error. *Dower* v. *Richards*, 151 U. S. 658; *Egan* v. *Hart*, 165 U. S. 188. *Judgment affirmed.*

For statement of facts and other information as to this case see Annual Report, State Forest Commission, 1890, pp. 153-160, People *vs.* Turner, Supreme Court, opinion of Hand, referee.

UNITED STATES CIRCUIT COURT,

NORTHERN DISTRICT OF NEW YORK.

THE SARANAC LAND AND TIMBER COMPANY,
vs.
JAMES A. ROBERTS, as Comptroller, etc.

At Law. Tried by the Court. For decision on demurrer, see 68 Fed. Rep., 521.

FRANK E. SMITH and WEEDS, SMITH and CONWAY for the plaintiff.

T. E. HANCOCK, G. D. B. HASBROUCK, E. H. LEGGETT and JOHN H. BURKE, for the defendant.

COXE, *J.*: I am of the opinion that this cause must be decided in favor of the defendant upon the authority of *People* v. *Turner*, 145 N. Y. 451, affirmed by the Supreme Court of the United States, October 18, 1897. By these decisions the constitutionality of chapter 448 of the laws of New York of 1885 is affirmed and its validity, as a curative act and as a short statute of limitations, is fully recognized. The defects involved in the Turner case were similar to, and, in some instances, identical with those relied on by the plaintiff in the case at bar.

Assuming these defects to be proved, they were irregularities which were cured by the act of 1885. *The plaintiff has failed to show either the payment of the taxes or that they were levied without legal right. In other words, it has failed to show jurisdictional errors such as would render the assessment proceedings void and which the legislature had no power to remedy.*

The court cannot adopt the view of the learned counsel for the plaintiff in his ingenious effort to prove that the constitutionality of the act of 1885 is still an open question. His argument is sufficiently answered by the plain and unequivocal language of the Supreme Court, as follows:

"It was argued in behalf of the plaintiff-in-error that the statute was unconstitutional, because it did not allow him any opportunity to assert his rights, even within six months after its passage. But the statute did not take away any right of action which he had before its passage, but merely limited the time within which he might assert such a right. Within the six months, he had every remedy which he would have had before the passage of the statute. If he had no remedy before, the statute took none away. From the judgments of the Court of Appeals in the case at bar, and in the subsequent case of People vs. Roberts, 151 N. Y. 540, there would appear to have been some difference of opinion in that court upon the question whether his proper remedy was by direct application to the Comptroller to cancel the sale, or by action of ejectment against the Comptroller or the Forest Commissioners. But as that court has uniformly held that he had a remedy, it is not for us to determine what that remedy was under the local constitution and laws."

The plaintiff has failed to prove that it "is seized in fee simple and entitled to the possession" of the lands in dispute.

The complaint is dismissed with costs.

NOTE. As the decision is based solely upon the main issue—the failure of the plaintiff to establish the invalidity of the sales for the non-payment of taxes—it would seem that all that is necessary is a finding of fact and a conclusion of law based upon the proof in this particular. Rulings upon each of the numerous requests presented, many of which have no relevancy to

the proposition upon which the decision rests, would, apparently, be inconsequential. Should the plaintiff, after examination, deem it important that such rulings be made I will hear counsel orally on Tuesday, December 7th, at Utica; provided they do not in the meantime agree as to the form of the findings.

It is, in my judgment, very doubtful whether the court can take judicial notice of the facts stated in the papers sent to me by plaintiff's counsel November 3d. I may say, however, that if proved they would not change my view as to the law. The question whether they should be received in evidence can be considered hereafter. A. C. C.

SUPREME COURT,

Appellate Division—Third Department.

The People of the State of New York, *ex rel.* The Forest Commission, *vs.* Frank Campbell, Comptroller.	Two cases. Argued September 7, 1898. Decided Nov. 16, 1898.

For prior decisions in these cases, see People *ex rel.* Forest Commission *vs.* Campbell, 82 Hun. 338, 152 N. Y. 51, 22 Applt. Div. 170, 156 N. Y. 64.

Merwin, *J.*: The only remaining question to be considered in these cases is, what direction shall be given or condition imposed by way of restitution to Benton Turner, for whose benefit these proceedings are defended, for monies paid by him into the treasury of the State or laid out on the premises in question.

The cancellation of December 30, 1891, was made upon the condition that "all the taxes for which the said lands were so sold, and all other taxes that are now a lien upon said land" should be paid.

It appears that on December 31, 1891, Benton Turner paid into the State Treasury the sum of $9,538.21. This as indicated by the papers submitted to us on the subject of restitution was made up as follows:—

Taxes of 1866, 1867, 1868. 1869, 1870, for the non-payment of which the land had been sold in 1877, with interest to December 31, 1891,	2,128	47
Taxes of 1861, 1862, 1863, 1864, 1865 for the non payment of which the land had been sold at the tax sale of 1890, with interest to December 31, 1891,	6,705	59
Taxes of 1886, 1887, 1888, 1889, 1890, with interest to December 31, 1891,	704	15
Total,	9,538	21

At the tax sale of 1890, above referred to, the property was bid in by the State and a certificate issued to it.

This certificate was on December 31, 1891, assigned by the Comptroller to Smith M. Weed, and at the same date an assignment thereof made by Weed to Julia H. Turner. On the back of this assignment as certified from the Comptroller's office, it is noted that a conveyance was made to Julia H. Turner, December 29, 1892.

On the 18th of May, 1886, Mr. Turner, through his attorney, paid into the State Treasury the sum of $1,306.30 for redemption of the premises from the tax sale of 1881 made for the taxes of the years 1871 to 1876. On December 27, 1887, he paid into the treasury the sum of $1,124.61 for redemption of the premises from the tax sale of 1885 made for the taxes of 1877, 1878, 1879 and for 1853, 1854 and 1855.

An affidavit of Mr. Turner is presented in which it is stated that after the cancellation of December 30, 1891, he, believing his title perfect, entered upon the land and made preparation for extensive lumbering operations, building a dam across Cold Brook at an expense of $3,500; building sluice-ways and improving the brook to make it available for running logs at an expense of $3,000; building several camps, barns and other buildings for use in lumbering business at an expense of $5,350; building roads and bridges at an expense of $1,500; that these buildings and improvements are practically useless to him except for the purpose of utilizing the timber on said premises, except that the main camp was to some extent used in aid of the lumbering operations on an adjoining tract, Township 27, owned by him; that in June, 1892, after this expense was incurred, an injunction was served upon him on behalf of the State, restraining him from entering on the land.

On the part of the relator an affidavit of Cyrus P. Whitney, a civil engineer, is presented in which it is in substance stated that he is familiar with the lands in question and with lumbering; that the improvements mentioned by Turner were made long before December 31, 1891, and for the purpose mainly of lumbering on Turner's adjoining tract and many of the buildings are on that tract; that the cost of the buildings is largely overstated and many of them are now rotted down. It also appears on behalf of the relator that on June 6, 1891, The People of the State recovered judgment against Turner for $2,198.60. On the affirmance of this at General Term a further judgment was recovered against Turner for $72.04, May 18, 1894, and on the affirmance of this by the Court of Appeals a further judgment of $151.75 on February 17, 1898. These judgments are shown to be unpaid. The recovery in the original judgment was for the value of logs taken by the defendant therein from the premises in question about March 1, 1887. It is not suggested by the relator that Turner has taken any other timber or had any other use of the property that should be considered on the question now before us.

The defendant, or rather Turner through the defendant, claims that as condition of the reversal of the determination of the Comptroller, the amount paid by him on December 31, 1891, being the sum of $9,538.21 should be restored to him. Before Turner is in a position to ask this, he should restore to the State all the rights it had under the certificate given to it on the 1890 sale, so that there will be no outstanding claim against the State or the property by reason of the transfer of that certificate or any conveyance that may have been given thereunder.

Such restoration being made Turner then would be in a position to ask that the money that he paid December 31, 1891, be paid back to him upon the reversal of the Comptroller's determination.

It is also claimed on behalf of Turner that he should be reimbursed for his expenses for improvements as stated in his affidavit. This is on the theory that he made the expenses after December 31, 1891, in the belief that his title was perfect. It is denied that they were made after that date. If made at the time he says he knew that it had been determined in an action at law against him by the State that he had no title and it can hardly be said that under the circumstances appearing in the case, he had a right to suppose that the relator would acquiesce in the action of the Comptroller upon December 30, 1891. Beyond this it is quite apparent from the affidavit of Mr. Turner himself that the improvements described by him were and are of no benefit or use to the relator or the State for the purposes of its Forest Preserve, but, on the

contrary, detrimental to it. The State has received nothing by reason of such expenses. I fail to see any good reason for our considering those expenses upon the subject of restitution.

The amounts paid by Turner on May 18, 1886, and December 27, 1887, for redemption from tax sales of 1881 and 1885 stand on a different basis. The deed to the State upon the tax sale of 1877 which is restored by a reversal of the determination in question was given prior to such tax sales.

If the deed was good and operative, the State upon the sales in 1881 and 1885 was selling its own property, and Turner by redeeming got nothing.

We therefere reach the following conclusion:

The determination of the Comptroller should be reversed with costs unless within sixty days after the entry of the judgment herein and service of a copy thereof on the defendant's attorneys, the defendant's attorneys file with the clerk of this Court for delivery as directed by the Court, and serve on the attorneys for relator, an instrument or instruments duly executed which shall operate to transfer and restore to the State any and all right or interest which it parted with by reason of the transfer of the certificate of the 1890 tax sale or any conveyance thereunder.

In case such instruments are so filed and served, then such reversal is made upon the condition that within ninety days after the filing and service of said instruments, the relator deposit or cause to be deposited in court subject to the order of this Court for the benefit of said Benton Turner, or his assigns, the said sum of $9,538.21 with interest thereon to the time of such deposit. Also the said sums of $1,306.30 and $1,124.61 with interest from their respective dates of payment, less the said three judgments.

Upon such deposits being made, then the said reversal shall be absolute and the instrument or instruments above referred to shall be delivered to the relator for the State, and the said monies shall upon application be paid to said Turner or his assigns.

In case such deposit is not made within said time or such further time as may be given by this Court upon proper application at the foot of the judgment, then the writs of certiorari shall be quashed.

All concur.

Judgment ordered in accordance with the opinion to be settled before the Court upon notice.

29

SUPREME COURT,

ST. LAWRENCE SPECIAL TERM, OCTOBER, 1898.

FERRIS J. MEIGS,
vs.
JAMES A. ROBERTS, as Comptroller of the State of New York.

JOHN P. BADGER, for plaintiff.

THEODORE E. HANCOCK, Attorney-General, for defendant.

RUSSELL, *J.*: Standing in front of any view of the merits of the controversy between the plaintiff and the State of New York as to the validity of plaintiff's title to the real estate in controversy, is the question of right to test the merits of plaintiff's claim in an action of ejectment brought against the Comptroller of the State. If a determination in favor of the plaintiff would produce only a barren judgment then the action will not lie to determine an abstract question. If the servant of the State has no such actual occupancy that the judgment against him would prevent other agents of the State from acts of possession or protection over the property, then this action cannot be maintained for any effective purpose.

The subject of the controversy is wild land embraced within the Forest Preserve and claimed by the State under tax sales. The Act of the Legislature establishing a Forest Commission, and defining its powers and duties and for the preservation of the forests, is chapter 283 of the Laws of 1885. By that Act all lands owned or thereafter acquired by the State within certain counties should constitute the Forest Preserve, be kept forever as wild forest lands, and the Forest Commissioners should have the care, custody, control and superintendence of the Preserve. Sections 7, 8 and 9.

The duties of the Forest Commissioners, Warden, Inspectors and Foresters are specifically designated by sections 9, 10 and 11, and by the latter section the Forest Commissioners are empowered to bring, in the name of the People, actions to recover damages for injuries and trespasses and also to prevent such injuries.

By the legislation of the State, lands may be acquired by purchase for the People of the State, to be included in the Forest Preserve, and also by tax sales, in the consummation of which the Comptroller, as the officer of the State, has certain duties to perfect the title so that the lands bought in by the State upon tax sales may be turned over to the proper Board to whose custody, from the moment the State acquires the lands, the property accruing to the State shall be confided.

The plaintiff insists that he has the right to maintain ejectment against the Comptroller, in order that the Court may decide that the State did not properly acquire the lands now claimed by him, by force of Section 13 of chapter 711, Laws of 1893, which is here quoted:

> "Section 13. Possession of lands by the State. The Comptroller may advertise once a week for at least three weeks successively, a list of the wild, vacant and forest lands to which the State holds title, from a tax sale or otherwise, in one or more newspapers to be selected by him, published in the county in which the lands are situated, and from and after the expiration of such time, all such wild, vacant and forest lands are hereby declared to be and shall be deemed to be in the actual possession of the Comptroller, and such possession shall be deemed to continue until he has been dispossessed by the judgment of a court of competent jurisdiction."

The object of this section is plainly to give a theoretic possession to the Comptroller, or the seisin which theoretically accompanies title, as the last act in the chain of the perfection of title by the State acting through its officer and servant. It is in no manner inconsistent with the power of actual occupancy, of protection, of care and right of action to prevent or redress injuries, confided to the Forest Commission, whose power as well as whose duty in these respects begins the instant the State has thus perfected title. This section of the Act of 1893 is not followed by any such distinctive and suitable direction for the actual occupancy and possession by the Comptroller, and protection, as mark the provisions of law in regard to the powers of the Forest Commission, but is followed alone by conditional powers of cancellation or other action looking to a restoration of the title through the Comptroller to the actual owner. The whole theory of the statute in regard to the Comptroller is to make him the officer to perfect title through tax sales and in some cases to exercise discretion to cancel or do certain acts for purposes of redemption; while the whole theory of the laws in regard to the Forest Commission is to give to them whatever of actual custody becomes necessary to accomplish the purposes for which the lands were acquired for the Forest Preserve.

Turner *vs.* New York, 168 U. S. Rep. 90.
People *vs.* Turner, 145 N. Y. 451.

It is well known that no action can lie against the State in one of its own courts, and the authority to take from it any money or property by judgment must be distinctly expressed and cannot be implied.

People *vs.* Dennison, 84 N. Y. 273.

It was even doubted once in England whether the King could maintain ejectment because ejectment might not be maintained against him.

Adams on Ejectment, 78.

As a matter of course the State cannot be dispossessed of its property in its own courts by an action in form against its servant or officer. As a matter of grace the State may, by the creation of a Board of Audit or State Board of Claims, allow remedial process against itself which it will recognize. The United States has occasionally permitted ejectment against its own servants or lessees.

Grisar *vs.* McDowell, 6 Wall., 363.
Meigs *vs.* M'Clung's Lessee, 9 Cranch, 11.

But such rights are those purely of favor and must be expressly conceded in order to justify action.

It follows, therefore, as a logical conclusion, that an action to determine the title of the plaintiff as against the State of New York cannot be maintained in the courts of the State of New York unless that State has in some manner expressly given its consent to such form of procedure. The statute relied on by the plaintiff does not give such consent. The theory of all the legislation in regard to the Forest Preserve forbids even the implication of such consent. The Comptroller is not in occupancy, legally speaking, of these wild lands to such an actual extent so that the judgment would disturb the possession of the State; and if he were, no lawful authority of the State of New York has ever consented that such a judgment should affect the title of the People to any portion of the Forest Preserve.

The complaint is therefore dismissed, with costs.

SUPREME COURT,

FRANKLIN COUNTY

SMITH M. WEED, and another,
vs.
JAMES A. ROBERTS, as Comptroller of the State of New York, and others.

Application for injunction pendente lite.

FRANK E. SMITH, for plaintiffs.

T. E. HANCOCK, Attorney General for defendant Roberts.

FRANK L. BELL for defendant Davis and others as Commissioners, etc.

E. COUNTRYMAN, of counsel for defendants.

MCLAUGHLIN, *J.*: There are many difficult questions of law involved in this proceeding, and to grant the injunction asked for by the plaintiffs would be in effect to decide these questions in their favor before the trial, and this a court of equity will not do unless it be first established that it is necessary in order to prevent an irreparable injury, or that the plaintiffs have an undoubted legal right to it. The papers presented do not establish either, and therefore the application must be denied. My reasons for reaching this conclusion are as follows:

First: It does not appear that the act of the Comptroller, it he considers the application referred to, will be in any way prejudicial to the rights of the plaintiffs. The Comptroller not only denies that he has determined or formed any intention to grant the application, but in addition he alleges that he has formed no opinion as to the merits of it. It is, therefore, fair to assume, if the plaintiff's contention be correct, either as to law or facts, that the Comptroller will not grant the application.

Second: I do not think that chapter 392 of the Laws of 1897 is repugnant to the Constitution. The power conferred upon the Comptroller to vacate or set aside the cancellation of a tax sale made by his predecessor in office, is a valid exercise of legislative power. If the Legislature could confer the power to cancel in the first instance, it necessarily follows that it could thereafter confer upon the same officer power to vacate or set aside a cancellation. In other words, it could authorize him to reconsider or re-hear the matter once passed upon, and revise, reverse or confirm his former decision. The fact that the cancellation was made, not by the present Comptroller but by his predecessor in office, is immaterial. The office is a continuous one, and a new Comptroller takes up the business pertaining to the office just where it was left by his predecessor, and carries it on in the same manner and with the same legal effect as if he had been the Comptroller during the preceding term.

Third: If the Comptroller entertains the application, and his decision thereon be adverse to these plaintiffs, they can review his action by writ of certiorari, and if illegal the same will be reversed (People *ex rel.* Forest Commission *v.* Campbell, 158 N. Y. 51).

Fourth: The plaintiffs have an adequate remedy at law. If the tax sale referred to is invalid, their title to the land in question is not affected, they may keep and defend their possession of it, or, if put out of possession, they may regain it by an action of ejectment (People *ex rel.* Hillard *v.* Roberts, 151 N. Y. 543).

Finally, a court of equity will not entertain a suit to prevent a cloud upon title to land unless it be made to appear that there is a determination on the part of the defendants to create the cloud, and it is not sufficient that the danger is merely speculative; it must exist; it must be

real (Clark *v.* Davenport, 95 N. Y. 482; Saunders *v.* Yonkers, 63 N. Y. 489). There is nothing which shows or tends to show that the act of the Comptroller will be adverse to the plaintiffs. The proceeding to vacate and set aside the cancellation may never be perfected; it may be abandoned; the Comptroller may refuse to vacate. The most that can be said is that the Comptroller may act, and that his act *may* be adverse to the interests of the plaintiffs. Something more than this must be shown.

The application for injunction pending the action is denied with ten dollars costs, to abide the event. The form of the order to be agreed upon, or in default thereof, to be noticed for settlement before me (at least two days' notice to be given) on the 31 inst. at 10 A.M.

SUPREME COURT,

FULTON COUNTY.

THE PEOPLE OF THE STATE OF NEW YORK,
vs.
RUSSELL E. HOLMES.

The contention of defendant that the action cannot be maintained since the act under which it was brought was amended in 1896, and by implication repealed, might have been prior to the statutory construction law, a serious question; by that law the action is saved and "may be prosecuted to final effect in the same manner as if such provisions had not been repealed."

The contention that plaintiff's title based upon a tax sale is void because the failure of the Board of Supervisors to "extend the tax" before adjournment, I do not think is sound.

The supervisors had fully executed their judicial functions when they equalized the property values, determined the claims and fixed the amount to be raised. The rest was simply clerical, and the extension of the tax involved nothing judicial, neither reason nor judgment. If this can be counted an irregularity as has been sometimes held, it was one of the least of the class of irregularities intended to be cured by chapter 448 of the Laws of 1885.

In People *v.* Hagadorn, 104 N. Y. 516, the effect of the Curative Law of 1885, or of the power of the Legislature by enactment to cure defects in procedure before sales for taxes, was not discussed or passed upon, hence, is not authority upon the question involved in this action.

In Ensign *v.* Barse, 107 N. Y. 329, the question as to the power of the Legislature and the effect of similar statute was before the Court for decision, and the opinion of Finch, *J.*, concurred in by all the Court, it seems to me, is decisive of the question here. The principle declared in Ensign *v.* Barse (*supra*) was repeated in Terril *v.* Wheeler, 123 N. Y. 76, and in the opinion of Earl, *J.*, this language is found:

> "The taxes were not invalid for want of jurisdiction to impose them, not because any constitutional rights of the tax payer had been disregarded or violated, but they were invalid because the *law had not been strictly pursued in their imposition, and hence there was legislative competency to cure the defects and to confirm them,*" Clementi *v.* Jackson, 92 N. Y. 591; Ensign *v.* Barse, 107 N. Y. 329; Williams *v.* City of Albany, 122 N. Y. 154.

The question was again passed upon in Cromwell *v.* McLean, 123 N. Y. 474. Peckham, *J.*, said:

> "The defendant claims that the act is valid as an exercise of the power to cure defects in assessments and other proceedings for the imposition and collection of taxes. Such curative power is a branch and a part of the legislative power to tax and must be sustained under it. The Legislature undoubtedly has large powers in the way of curing defects in proceedings to tax the citizen. In cases where the proceedings have been such that the citizen has had his chance to be heard before the tax was finally imposed, but nevertheless defects have been discovered in such proceedings, if the thing omitted and which constitutes the defect be such a nature *that the Legislature might, by prior statute, have dispensed with, or if something had been done, or done in a particular way which the Legislature might have made immaterial, the omission or irregular act may be cured by a subsequent statute.*"
>
> "This was so stated and in substantially identical language in Ensign *v.* Barse (*supra*)."

What rights of the citizen taxpayer were violated by the failure of the whole Board of Supervisors to perform this clerical work of extending the tax? Could not the Legislature have properly imposed this clerical duty upon a single supervisor or upon the clerk of the Board or even upon the collector himself? Surely, there are here no rights of the citizen to be considered. It does not appear in this case, nor is it alleged, that there was an error in the extension of the tax, or that the land was sold for any tax in excess of the amount levied by the Board. This defect in procedure, it seems to me, is not jurisdictional, and it appears to be one of the least of the defects which the Legislature had power to cure and did cure by chapter 448 of the Laws of 1885.

Under the second cause of action alleged in the complaint, and upon the theory upon which this action was tried, I think the plaintiff is entitled to recover against this defendant for at least the sum for which judgment is directed, which sum is less than treble the amount of the value, as found, of the trees standing and not in excess of the value as found, or the timber before it was carried off of the land.

The allegation "caused to be cut and carried away and assisted in cutting and removing, and converting to his own use timber and logs remaining on said premises" is a sufficient allegation under the proof to charge the defendant, at least, with the value of the logs upon the skidways upon the lands of the plaintiff.

S. A. KELLOGG,
J. S. C.

NOTE.—The above judgment was subsequently affirmed by Appellate Division.

THE END.